MONTHLY WEATHER REVIEW.

Editor: Prof. CLEVELAND ABBE.

VOL. XXVI. APRIL, 1898. No. 4

INTRODUCTION.

The MONTHLY WEATHER REVIEW for April, 1898, is based on 2,929 reports from stations occupied by regular and voluntary observers, classified as follows: 147 from Weather Bureau stations; numerous special river stations; 32 from post surgeons, received through the Surgeon General, United States Army; 2,583 from voluntary observers; 96 received through the Southern Pacific Railway Company; 13 from Life-Saving stations, received through the Superintendent United States Life-Saving Service; 31 from Canadian stations; 20 from Mexican stations; 7 from Jamaica, W. I. International simultaneous observations are received from a few stations and used, together with trustworthy newspaper extracts and special reports.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Meteorologist to the Government Survey, Honolulu; Dr. Mariano Bárcena, Director of the Central Meteorological Observatory of Mexico; Mr. Maxwell Hall, Government Meteorologist, Kingston, Jamaica; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; and Commander J. E. Craig, Hydrographer, United States Navy.

The REVIEW is prepared under the general editorial supervision of Prof. Cleveland Abbe.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the REVIEW, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to generally conform to the modern international system of standard meridians, one hour apart, beginning with Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local meridian is mentioned.

STORM WARNINGS AND WEATHER FORECASTS.

By Lieut. Col. H. H. C. DUNWOODY, Supervising Forecast Official.

Under this head it is proposed to make note of all extreme and injurious weather conditions occurring during the month, and the warnings of the same issued by the Bureau, with instances, as far as reported by observers or the press, in which these warnings were of special public benefit. The signals displayed by the Weather Bureau will be referred to as "information," "storm," "hurricane," "cold-wave," and "norther," respectively.

The injurious conditions of note that have occurred during the month were the severe frosts of the 6th and 9th in the South Atlantic and Gulf States, the storms of the 13–15th and 18–20th in the Lake Region, and of the 26–29th on the Atlantic Coast, the severe norther of the 12–13th in California, and the flood in the middle Mississippi River.

FROSTS OF THE 6–9TH.

Heavy frosts occurred on the morning of the 6th to 9th, inclusive, in the South Atlantic and Gulf States, with light frost on the 8th as far south as Jacksonville. Warnings of these frosts were issued from the Central Office on the mornings of the 5th, 6th, and 7th, and extensively distributed throughout the regions named. The district subject to the greatest injury from frost at this time was the trucking region of North Carolina, and the following reports from the Weather Bureau officials of that region show the distribution of the warnings and their value to the interests affected.

From Mr. C. F. von Herrmann, section director, Raleigh, N. C., April 26, 1898:

Warnings were issued by telegraph from Raleigh indicating the probable occurrence of frosts on Wednesday, Thursday, and Friday mornings (April 6, 7, and 8). The number of regular display stations reached was fifty-four, of which twenty-four lie in the important eastern trucking section of North Carolina. Special warnings were also sent to eleven other points, and a number of replies to urgent inquiries by telegraph from persons not on our regular list. The warnings were also widely distributed by mail from Raleigh, Tarboro, and Parmele by the logotype system. A number of displaymen, besides posting warnings at the post office and depots, also distributed them by telephone to the principal truckers in their vicinity; they were also, where opportunity offered, sent into the country, and circulated verbally, so that, especially in the most important eastern section, they unquestionably were very widely disseminated. The average time that the warnings were received in advance of the frost was fourteen hours, amply sufficient to enable crops to be protected.

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The universal interest in the warnings is emphasized in nearly all communications received. The following typical extracts from such letters will be sufficient to convince any one on this point. Mr. H. R. Horne, of Fayetteville, writes: "Our truckers and others have shown much appreciation of these forecasts. The daily telegrams were displayed as soon as received, and telephoned to the principal truckers. The crop to which most attention has been given here and for which the warnings have been of most value is that of strawberries. The general method of protection is to cover with pine straw. The expense of covering these crops is quite an item to the truckers, and the acreage is such that it is important that the forecasts be received as early in the morning as practicable in order to give the time necessary to complete the work of protection. The only suggestion we have to offer is that in case of threatening weather forecasts be as definite as to frosts as practicable. We think that more interest is shown in the forecasts now than ever before."

Mr. W. P. Baugham, of Washington, N. C., states:

"I am glad that you wish an expression as to the value of the forecasts for the past few days. There is hardly any telling how much good we derive from them. As soon as received we notified all, in person or by telephone, and the result was that all early vegetables, garden and cold frame crops, potatoes, etc., were covered, the latter by furrows with plows. The berry crop was all covered with pine straw and saved. The saving was thousands of dollars. Please continue the service, as otherwise all of us who are interested in farming will feel like discontinuing trucking."

From Mr. W. H. Fallon, observer, Wilmington, N. C.:

No frost of consequence has occurred in this section of the State during the past season without ample warning. Upon the receipt of each warning every effort was immediately made to distribute the same to every section of eastern North Carolina by means of the telegraph, telephone, mail, bulletin, and the press. * * * We reached by telegraph as far north as Goldsboro, as far northeast as Newbern, and as far west as Hamlet and Fayetteville.

The damage done by the frost since the 1st of the month, thanks to the warnings, was nominal. From the best obtainable information $5,000 will cover it. Potatoes, beans, and peas were about all the vegetables injured, and they only slightly. It is safe to assert that at least $100,000 were saved. The following statement furnished by Mr. H. T. Bauman, shipping master of the Fruit Growers' Association, pretty well covers the case:

"WILMINGTON, N. C., *April* 14, 1898.

"The frost warnings of recent dates were received at Wilmington and vicinity from ten to twelve hours in advance of the frosts, thereby giving our truckers and strawberry growers ample time to arrange for the protection of these crops. The warnings were posted at all the principal points along the line of the several railroads, where the growers could see and profit by them. This they did by covering their plants with pine straw, which is a certain protection against cold and frost. The property protected was principally strawberries, the approximate value of which was between $600,000 and $800,000. I think it would be safe to say that the value saved through these warnings will amount to $100,000. Our growers fully appreciate this service of the Weather Bureau and your prompt dispatch of all information to the several localities in this territory."

STORMS OF 13–15TH AND 18–20TH.

Concerning these storms and the warnings issued on their account Prof. E. B. Garriott, in charge of the Weather Bureau office at Chicago, Ill., reports:

During the night of the 12–13th a storm of considerable force developed over northern Illinois. Northwest storm signals were ordered up on Lake Michigan at 9:30 a. m. on the 13th, and northeast signals at the same time on Lake Huron. High northerly winds prevailed on Lake Michigan during the 13th, and practically all vessels, except the regular liners, were unable to go northward until the morning of the 14th. On the evening of the 13th Captain Boswell of the steamship *City of Louisville* called up the Chicago office by long distance telephone from St. Joseph, Mich. With a view to making the trip over to Chicago that night he desired to ascertain the indications. He was told that the wind would haul around from east to high northerly within two hours. He afterwards stated that this information had been of great value to him, as such advice usually was. Knowing that the wind would shift to north in a short time, he was able to shape his course accordingly, escaping the severe cross sea which he would have experienced had he taken his regular course.

Another storm moved from the northwest southeastward to the Arkansas Valley from April 14 to 18, after which it took a northeasterly direction over the Lakes, attended by high winds during the 18th, 19th, 20th. Northeast storm signals were ordered up at Chicago at 10 p. m. April 17, and elsewhere on Lake Michigan on the 18th, and also on Lake Huron, except the extreme northern portion. At 9:30 a. m. on the 19th the signals were ordered up on the rest of Lake Huron and the eastern portion of Lake Superior. The display of signals continued forty-eight hours. During the gale of the 19th the steamer *J. H. Outhwaite*, towing the schooner *H. A. Barr*, became disabled on Lake Huron and both vessels were driven ashore on False Presque Isle Point. Although he had encountered the gale early in the day, the captain of the *Outhwaite* determined to press on to the Straits of Mackinac, and he believes that he would have succeeded had not his machinery become disabled. As both steamer and consort were without cargo and bound up Lake Huron, it was a most foolhardy undertaking.

STORM OF 26–29TH.

This storm developed in the Ohio Valley during the night of the 25th and moved thence to the south Atlantic Coast by the night of the 26th. It was central off the South Carolina Coast on the morning of the 27th, off the North Carolina Coast on the morning of the 28th, and off the New England Coast on the morning of the 29th. It caused unusually severe gales and high tides on the middle Atlantic Coast, the following maximum velocities in miles per hour were reported during its progress, viz: Savannah and Charleston, 42; Wilmington, 48; Cape Henry, 68; Cape May, 40; Atlantic City, 44; New York, 36; Sandy Hook, 60; Block Island, 72; and Nantucket, 48.

Information signals for this storm were ordered from Jacksonville to Wilmington and northeast storm signals at Capes Hatteras and Henry at 10:30 p. m. of the 26th; at 10:00 a. m. of the 27th the northeast storm signals were extended to the New England Coast, all signals being well in advance of the dangerous winds. Warnings were also issued of the expected high tides, concerning which the following extract from the Norfolk Virginian and Pilot of April 28 is given:

Owing to the warnings very generally disseminated by the Weather Bureau very few were caught by the high water and little damage resulted.

FLOODS IN THE MISSISSIPPI.

The flood in the Mississippi was a continuation of that noted in the March REVIEW; the following reports from the Weather Bureau officials in the regions affected and from newspaper extracts are given:

From Mr. P. H. Smyth, observer, Cairo, Ill., May 14, 1898:

With the exception of the deplorable disaster at Shawneetown, Ill., on April 3, 1898, resulting from a break in the levee, whereby the town was inundated, 30 persons were drowned, and considerable property destroyed, the recent flood did no very great damage in the Cairo district. Railroad traffic was interrupted but very little; river navigation was practically uninterrupted; and residents of lowlands, having been amply forewarned by the Weather Bureau, removed themselves and property to places of safety, and suffered little or no loss.

The progress of the flood was carefully watched from day to day, and predictions of the stages at the several points in the Cairo section were issued when thought necessary. A detailed statement of existing river conditions was published daily on the weather map, and the maps were mailed to all points on the rivers that could be reached.

When thought necessary, forecasts were telegraphed to Evansville, Ind., Shawneetown, Ill., and Paducah, Ky.

The warnings telegraphed to the observer at Evansville were furnished the newspapers at that place, and telephoned to persons interested. The special reports telegraphed to Mr. S. A. Fowler, Paducah, Ky., were bulletined, and published in the newspapers of Paducah.

The special reports sent to Mount Vernon, Ind., and Shawneetown, Ill., were bulletined daily, and widely distributed by mail from those points. In addition to the regular river messages telegraphed daily to Evansville, Paducah, Louisville, and Chicago, special river messages were, during the period of high water, telegraphed daily to Mount Vernon, Ind., Shawneetown, Ill., Memphis, Tenn., Vicksburg, Miss., Arkansas City, Ark., and New Orleans, La.

It is safe to say that there is not a person in the threatened region but manages in some way to keep informed as to what the rivers are doing, and about how much water to expect. From the time that the river approached the danger line at Cairo until all danger was over, the office was daily visited by farmers, lumbermen, and others seeking information.

Undoubtedly the reports and warnings were of great value, and the means of saving much property. Crops did not suffer to any great extent, as the flood was not of long duration, and subsequent weather conditions were favorable. Very little planting has been done in the lower bottoms.

The river was above danger line at Evansville, Ind., from March 21 to April 12, 1898, inclusive. At Cairo the water was above danger line from March 24 to April 16, inclusive.

The predictions issued from this office in connection with this flood, were as follows:

Wednesday, March 23.—The lower Ohio will continue rising during the remainder of this week, and probably longer. At Evansville a stage of about 37 feet will be reached by Thursday morning (24th); at Paducah a stage of about 32.5 feet will be reached by Thursday morning (24th); at Cairo the danger line (40 feet) will be passed by Thursday afternoon (24th). The Mississippi from below St. Louis to Cairo will rise during the next forty-eight hours; from below Cairo to Memphis will rise for at least five days. On the morning of the 24th the stage at Evansville was 37.4 feet; at Paducah, 32.9 feet; and at Cairo, 40.9 feet.

Thursday, March 24.—The Ohio, at Evansville, will reach a stage of between 39 and 40 feet by Friday morning (25th); at Paducah, a stage of about 35 feet will be reached by Friday morning (25th); at Cairo, a stage of about 44 feet will be reached by Friday morning (25th). That part of the prediction referring to Evansville was telegraphed to the

observer at that point. The stages reached on the morning of the 25th were as follows: Evansville, 38.4 feet; Paducah, 34.4 feet; Cairo, 42.8 feet.

Friday, March 25.—The Ohio, at Evansville, will continue rising for at least three days; at Paducah and Cairo, will rise at a decreasing rate until Sunday (27th). A stage of about 35 feet will be reached at Paducah by Saturday morning (26th), and a stage of about 44 feet will be reached at Cairo by Saturday afternoon. At Paducah 35.6 feet was the stage reached on the morning of the 26th, and at Cairo a stage of 44 feet was reached by noon of the 26th (Saturday).

Sunday, March 27.—The Ohio will reach a stage of about 43 feet at Evansville Monday (28th), and 46 feet at Cairo Monday afternoon (28th). That part of the prediction referring to Evansville was telegraphed to the observer at that point. Forty-one and nine-tenths feet was reached at Evansville Monday morning (28th), and 45.9 feet at Cairo at 7 p. m. on Monday, 28th.

Monday, March 28.—The Ohio from Evansville to Cairo will continue rising. A stage of about 44 feet will be reached at Cairo by noon Wednesday, 30th. The stage at Evansville on the morning of the 30th was 43.7 feet; the stage at Cairo at noon of the 30th was 47 feet.

Tuesday, March 29.—The Ohio, at Evansville, will continue rising for three or four days, a stage of about 45 feet will be reached at Evansville by Thursday night (31st) or Friday morning (April 1); at Paducah and Cairo, will continue rising; 41 feet will be reached at Paducah by noon Wednesday (30th), and 48 feet will be reached at Cairo by Thursday noon (31st). The warning was telegraphed to Evansville and Paducah. Forty-four and seven-tenths feet was reached at Evansville on the morning of April 1; 41 feet was reached at Paducah on the morning of the 30th; and 48 feet was reached at Cairo on the afternoon of the 31st.

Thursday, March 31.—The Ohio, at Evansville, will rise slowly during the next thirty-six hours; a maximum stage of about 45 feet will be reached at Evansville on the present rise; at Paducah and Cairo will continue rising. At Cairo a stage of about 48.5 feet will be reached by Friday evening, April 1. The maximum stage reached at Evansville was 44.8 feet on the morning of April 2, the river then remaining stationary for twenty-four hours. At Cairo 48.8 feet was reached at 7:30 p. m. on April 1.

Friday, April 1.—The Ohio, at Evansville, rising slightly until to-night, very nearly stationary Saturday (2d); at Paducah, will continue rising until Sunday (3d), but at a decreasing rate; at Cairo, will rise at a decreasing rate for three or four days. The water in sight this morning indicates for Cairo a maximum stage of between 49.5 and 50 feet. The maximum stage reached at Cairo was 49.8 feet, on the morning of the 6th. The maximum stage predicted for Paducah was slightly above 46.5 feet; the maximum stage reached at Paducah was 47.3 feet.

The following are extracts from letters received at this office:

"EVANSVILLE, IND., *April* 11, 1898.

"So far as known there was not any money saving effected by these warnings, yet the citizens here have come to regard your forecasts as reliable, and many storekeepers along the river front, whose cellars were in danger of inundation, expressed themselves as much pleased with the forecast of the 29th. Much favorable comment was also made by the citizens generally regarding the correctness of the forecast."

"MOUNT VERNON, IND., *April* 19, 1898.

"In regard to benefits derived from river reports in recent floods; reports were very much sought after. We sent by mail daily about fifteen reports, and issued about fifty. Farmers from miles around made daily trips here to ascertain the stage of the water. About how much property was saved in dollars I can not state accurately, but it certainly would mount way up in the thousands. All boats were busy moving stock and people to high ground for weeks."

"PADUCAH, KY., *May* 4, 1898.

"The river reports have been of inestimable value, not only to the citizens of Paducah, but also to the timber men of the lower Tennessee and Ohio rivers, enabling them to prepare for the flood, and to remove to places of safety all goods and products. The reports sent me are each day published in the two daily afternoon papers and also in the morning daily, and through this medium reaches the entire community in a short time after receipt. The money value of stock and property saved by the reports will reach far up into the millions."

"CAIRO, ILL., *May* 13, 1898.

"The reports furnished us during the recent high water period were of great value to us at our sawmill in this county, the surrounding country sharing in the benefits. At our mill we have quite a settlement, a great many families. The warnings received gave us ample time to provide for our stock, and those in the lower lands to provide for theirs. They also guided us in floating in timber to our mill. In the vicinity of our mill there is quite a large farming country and the reports furnished at our mill have the credit of saving at least 50 acres of wheat, besides a pen of 750 bushels of corn. On the farms of Jas. Ice and Thos. Morningstar the levee broke last year, damaging at least 50 acres of growing wheat; they rebuilt the levees last fall, but not high enough. On learning the probable rise to be expected, they at once put all trams to work and built their levees high enough to keep the water from overflowing, and saved at least $1,200 to $1,500 by being warned.

"A pen of corn belonging to the Garret Bros. would have been lost had it not been for the reports sent by you.

"We call your attention to these facts which came under our direct observation, and know that the surrounding country shared equally in the benefits of the reports. Thanking you and your department for your kindness, we are, yours truly.

(Signed) SMITH BROS."

Cairo, Ill., Citizen, April 21, 1898.—The flood of 1898 is now a thing of the past. It was not so serious as that of last year in this vicinity, but from Memphis south the water reached a higher stage than last year. Owing to the excitement of war, little attention was paid to the overflow by the press or people. The river at this point was out of its banks from March 23 to April 16. The highest stage was 49.8 feet. It might be well here to state that the Weather Bureau predicted with almost perfect accuracy the maximum stage. They stated the river at Evansville would reach a maximum stage of 45 feet. It, in fact, stopped at 44.8. Here they predicted the water would come to a stand at between 49.5 and 50 feet. It stopped at 49.8 feet. These accurate predictions have increased the confidence of the public in the Weather Bureau, and the people will depend more than ever upon its warnings.

From Mr. S. C. Emery, local forecast official, Memphis, Tenn.:

During the recent high water which began in March and continued until near the end of April, the Mississippi was above the danger line in this section, as follows: Cairo, from March 24 to April 17, inclusive, and highest water, 49.8 feet; Memphis, from March 31 to April 20, highest water, 37.1 feet; and Helena, from April 6 to 24, inclusive, the highest being 49.1 feet.

During the above period most of the low lands in that portion of Arkansas comprising the county of Crittenden and the eastern half of St. Francis and Lee counties were badly flooded, as were the regions adjacent to the river on the Tennessee side in the counties of Tipton and Lauderdale. In some portions of the above area the water was higher than during any previous flood, but owing to the absence of breaks in any of the State or Government levees there was no rushing or sudden outbursts of water, but, on the contrary, the rise from first to last was steady and gradual. This being the case, ample time was afforded those living in the threatened districts to take advantage of the Weather Bureau warnings and prepare for the predicted overflow. The first regular warning issued from this office was on March 24 when the river stage at Memphis lacked 6 feet of the danger line, and this was followed by other warnings issued at intervals of four days until April 11, when the flood began to subside and all danger was past. These warnings were in the form of bulletins which gave a brief synopsis of the latest information at hand concerning the river conditions likely to affect this section, and a forecast of what might be expected in the near future. At each issue of these bulletins two hundred post offices in the threatened districts were supplied with one or more copies by mail, and the postmasters were requested to give them the widest possible circulation in their respective localities. The bulletins were also published in the daily papers. In addition to the warnings and forecasts thus issued, a daily report was furnished the local press, and the officials of the eleven railroads centering here, and by them transmitted over their respective lines for the benefit of the public.

The benefits resulting from the warnings and reports issued were pronounced, and form a striking illustration of the value of the River and Flood Service. Had it not been for the reports thus issued the levees would not have received the prompt attention needed to put them in condition to withstand the flood, and, as later events proved, they would not have been sufficient without the new work placed upon them after the overflow was predicted. The work of raising the levees was pushed forward rapidly, hundreds of men and teams being employed both night and day for about two weeks, and guards were placed along the entire line to watch for possible breaks.

Although the water in this section was higher than during the flood of 1897, or that of any previous year, and to all appearances the danger threatened was fully as great, there was no loss of life, and comparatively little damage to property, while the scenes of suffering and distress which characterized the flood of last year were entirely lacking in this. The preservation of the levees alone saved this section a sum of money more than equal to the total cost of maintaining the Weather Bureau one year. In the region unprotected by a levee the people were so well prepared for the overflow that the damage sustained was only moderate, and that mostly confined to the injury inflicted upon growing crops. Immediately upon the receipt of the information that an overflow was threatened, the people of Marion, the county seat of Crittenden County, Ark., erected a protection levee around the town, but on account of being too frail in its construction, it failed to keep out the water. There are a number of instances, however, where embankments were built around buildings and even growing crops, fully protecting them, so that flood warnings and forecasts were of especial

value to farmers and others occupying the low lands nearest the river. From these sections most of the live stock was transferred to high ground, and other movable property placed out of danger. Numerous letters have been received from the recipients of flood warnings, expressing appreciation of the Weather Bureau warnings.

NORTHER IN CALIFORNIA.

Mr. W. H. Hammon, forecast official at San Francisco, reports:

Only one injurious condition prevailed during the month, and that was the severe norther of April 12 and 13, ample warning of which was given on the morning of April 11. High desiccating north winds prevailed on the dates mentioned, which seriously blighted growing crops. However, the warning of these conditions is not generally of great benefit, as it is impossible to protect against them. In some irrigated sections an extra amount of water is run upon the land in advance of such periods, the evaporation of which tends to reduce the amount of injury.

FORECASTS IN OREGON.

Mr. B. S. Pague, local forecast official in charge of the Portland, Oreg., forecast district, reports as follows in regard to the forecasts and warnings issued from that station:

During the month no wind signal orders were issued, there being no storms.

The fishing season has opened. There are some 3,000 persons in fishing boats at the mouth of the Columbia River every day. The knowledge that there are no wind signal orders displayed is as valuable as the orders themselves would be. The cannery men, who employ the fishermen, carefully note the forecasts day by day.

Frost forecasts were issued and verified on several dates, but no benefits have been reported.

Rain forecasts are anxiously looked for, owing to the long absence of good general rains.

The temperature forecasts have been watched with considerable interest, owing to the effect the temperature now has on the snow in the mountains, the consequent melting, and the rise of the rivers and streams.

Special forecast information has been asked for and given quite frequently during the month concerning probable rain and the rise of the Columbia. Many people sow seeds, etc., along the river bottom on information issued from this office. One orchardist reported personally that he has found it most profitable and for the best interests of his orchard not to plow until the weather report states that "summer weather conditions" are present.

AREAS OF HIGH AND LOW PRESSURE.

By Prof. H. A. Hazen.

During the month 8 high areas and 7 low areas were sufficiently well defined to be traced on Charts I and II. The accompanying table gives the more important statistics regarding the beginning and advance of these highs and lows. These conditions during the month were remarkable for their definitions, duration, and distance over which it was possible to follow them. The average duration for both was 6.5 days. The average length of path was 3,825 and 3,887 miles for highs and lows, respectively.

HIGHS.

Of the 7 highs all but No. I began on the Pacific Coast and all were traced across the country to the Atlantic Coast. Nos. V and VII disappeared off the north Atlantic Coast and the others near the Florida coast.

LOWS.

Of the lows I and VII were first noted in Arizona, II and III near the north Pacific Coast, and IV and V in Alberta. No. VII was last noted in the St. Lawrence Valley, No. V off the middle Atlantic Coast, and all the rest over or near Newfoundland. As low I passed up the Atlantic Coast, a wind of 48 miles an hour was reported at Block Island, p. m. of 5th. Buffalo reported a 56-mile wind, p. m. of 20th, as low No. IV reached the lower Lake Region. The highest wind of the month, 72 miles an hour, was reported from Block Island, p. m. of 28th, as low VI moved up the Atlantic Coast. Many of the highs, and especially the lows, afforded a fair opportunity to study upper and lower cloud motion at or near their centers. In the case of lows the lower clouds in front almost invariably took the direction of the wind or toward the center. The upper clouds on the other hand, when the low moved almost due south, were moving either due east or toward northeast at right angles to the trajectory. The conclusion was rather strong, especially in the case of low VI, that the cause of motion in no case could be the general drift of the atmosphere either in the lower or in the higher layers. It would seem as though in all cases where there are well defined lows moving nearly south or southeast the motion of lower and upper clouds ought to furnish a criterion as to the motion being due to that of any atmospheric strata.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	Miles.	Days.	Miles.	Miles.
I	1, a. m.	50	106	4, a. m.	39	74	2,370	3.0	790	32.9
II	1, p. m.	47	129	9, p. m.	26	78	3,750	8.0	469	17.9
III	6, p. m.	36	124	12, p. m.	31	81	3,330	6.0	555	23.1
IV	10, a. m.	44	125	18, a. m.	32	79	4,140	8.0	517	21.5
V	13, p. m.	48	127	20, a. m.	44	65	3,360	6.5	517	21.5
VI	16, p. m.	42	126	21, p. m.	31	78	3,390	5.0	678	28.2
VII	20, a. m.	33	119	29, a. m.	48	56	5,220	9.0	580	24.2
VIII	26, a. m.	42	127	2, p. m.*	27	85	5,040	6.5	775	32.3
Total							30,600	52.0	4,881	
Mean of 8 tracks							3,825	6.5	610	25.2
Mean of 52 days									588	24.5
Low areas.										
I	1, a. m.	32	116	6, p. m.	47	57	3,870	5.5	704	29.3
II	4, p. m.	47	126	11, a. m.	37	78	3,390	6.5	522	21.7
III	9, a. m.	50	123	17, a. m.	49	60	4,920	8.0	615	25.6
IV	13, a. m.	55	113	22, a. m.	50	60	4,800	9.0	533	22.2
V	20, a. m.	53	118	25, a. m.	40	69	3,870	5.0	774	32.3
VI	24, p. m.	46	96	30, p. m.	46	58	3,300	6.0	550	22.9
VII	28, a. m.	34	113	3, p. m.*	46	77	3,060	5.5	556	23.2
Total							27,210	45.5	4,254	
Mean of 7 tracks							3,887	6.5	608	25.3
Mean of 45.5 days									598	24.9

* May.

THE WEATHER OF THE MONTH.

By A. J. Henry, Chief of Division of Records and Meteorological Data.

The statistical aspect of the weather of the month is presented in the tables which form the closing part of this Review. Table I in particular contains a variety of details from which the reader may select those most interesting to himself. The numerical values in the tables have been generalized in a number of cases, the results appearing on Charts Nos. III to VIII, inclusive.

PRESSURE AND WIND.

Normal conditions.—The geographic distribution of normal barometric readings at sea level and under local gravity for April is shown by Chart VI of the Monthly Weather Review for April, 1893.

In April there is usually a decrease of pressure over the United States and Canada, except along the north Pacific

Coast and over Maine and the Canadian Maritime Provinces, where the normal pressure is the same or greater than in March. The most marked decrease of pressure (0.10 inch) occurs in the upper Missouri and Mississippi valleys, on the northeastern slope of the Rocky Mountains, and over Arizona and contiguous portions of the Southwest.

In April southerly winds prevail in the middle and lower Mississippi Valley and the Gulf States; southwesterly on the south Atlantic and Pacific coasts and portions of the Plateau Region west of the Rocky Mountains; northerly and northwesterly winds continue over the northeastern slope of the Rocky Mountains, the Lake Region, New England, and the Middle Atlantic States. The most noticeable change in the direction of the prevailing winds of April as compared with those of March is the advance inland of southerly winds in the Mississippi and Ohio valleys.

The current month.—Pressure was above normal over practically the whole country. In the Great Valley of California and a portion of Arizona, and along portions of the north Atlantic Coast, pressure was slightly below normal.

A comparison of the pressure chart for April, 1898, with the corresponding chart for the preceding month shows a decrease of pressure over the eastern half of the United States, amounting to 0.30 inch on the New England Coast and at Halifax. It will be remembered that in March pressure was 0.30 inch *above* the normal in this region; the fall during April is, therefore, merely a return to normal conditions. There was also a fall in the pressure of April as compared with March over the Rocky Mountain and Plateau regions and the upper Missouri Valley. Pressure increased over Texas, the plains and upper Mississippi Valley, and over western Washington.

TEMPERATURE OF THE AIR.

Normal conditions.—The normal mean temperature of the air in the United States in April varies from about 76° at Key West, 69° at Jacksonville, 69° at New Orleans, 69° at Galveston, 58° at San Diego, to 38° at Eastport, 42° at Burlington, 42° at Buffalo, 46° at Detroit, 38° at Duluth, 37° at St. Vincent, 44° at Havre, 48° at Spokane, and 50° at Seattle, on Puget Sound. The warmest regions, as may be seen from the above figures, are the South Atlantic, and Gulf Coast States, southern Arizona, and the interior valleys of California; the coldest are the Red River Valley of the North and the Lake Region.

The differences between the normal temperatures of March and April are not large at stations on the South Atlantic, Gulf, and Pacific coasts, but at inland points, especially on the plains and in the upper Missouri Valley, the increase in the mean values of April over those of March is quite marked. The advent of spring in the last named region comes, therefore, a little earlier than in the Ohio Valley and elsewhere east of the Mississippi.

In studying the distribution of monthly mean temperatures it will be found very helpful to consult the charts at the end of this REVIEW, especially No. VI, Surface Temperatures, Maximum, Minimum, and Mean. This chart gives a very good idea of the variations of temperature with latitude and longitude, and also of the distribution of normal surface temperatures. Chart VI for any month will differ from a normal chart merely in the displacement or bending of the isotherms northward or southward according as the temperature of the particular locality is above or below the normal for the place and season.

The current month.—It will be recalled that March, 1898, was unseasonably warm over nearly all of the region east of the Rocky Mountains, and that it was colder than usual west of the mountains. These conditions were reversed in the current month. Roughly speaking, temperature was above the normal north of a line drawn diagonally from El Paso, Tex., to Lake Superior, and below the normal south of that line. The region of high temperature for the season (an excess of 3° or more per day) includes Nevada, western Utah, and southern Idaho, Arizona, and the eastern half of California, and southeastern Oregon. The region of abnormally low temperature (a daily deficit of 3° or more) includes the lower Mississippi Valley, Alabama, northwestern Georgia, western North and South Carolina, portions of Virginia, West Virginia, Kentucky, and Tennessee.

The lowest temperature of the month was generally experienced during the passage of low area No. I. This storm was attended by snow in the Ohio Valley and Middle Atlantic States, and freezing temperatures were registered southward to Arkansas, northern Louisiana, Mississippi, Alabama, Georgia, and South Carolina.

The lowest temperature registered at any station was 13° below zero at Kipp, Mont. Temperatures below zero were also registered in the mountain regions of Colorado.

The maximum temperatures of the month were generally registered from the 15th to the 18th, and from the 25th to the end of the month.

Maximum temperatures of 100° and over occurred in the lower Rio Grande Valley, Arizona, and the interior valleys of California. The highest temperature registered with standard instruments was 113° at Parker, a station in Arizona on the Colorado River, some miles north of Yuma.

The distribution of the observed monthly mean temperature of the air is shown by red lines (isotherms) on Chart VI. This chart also shows the maximum and the minimum temperatures, the former by broken and the latter by dotted lines. As will be noticed, these lines have been drawn over the Rocky Mountain Plateau Region, although the temperatures have not been reduced to sea level; the isotherms relate, therefore, to the average surface of the country in the neighborhood of the various observers, and as such must differ greatly from the sea-level isotherms of Chart IV.

The average temperatures of the respective geographic districts, the departures from the normal of the current month and from the general mean since the first of the year, are presented in the table below for convenience of reference:

Average temperatures and departures from the normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	10	42.3	+ 0.9	+11.2	+ 2.8
Middle Atlantic	12	49.2	− 1.5	+ 9.0	+ 2.2
South Atlantic	10	59.3	− 2.7	+ 3.6	+ 0.9
Florida Peninsula	7	69.4	− 1.6	− 0.1	0.0
East Gulf	7	62.3	− 4.2	+ 1.6	+ 0.4
West Gulf	7	64.7	− 2.4	+ 8.0	+ 2.0
Ohio Valley and Tennessee	12	52.1	− 3.8	+ 7.5	+ 1.9
Lower Lake	8	44.2	− 0.5	+14.8	+ 3.7
Upper Lake	9	41.7	+ 1.0	+17.3	+ 4.3
North Dakota	7	42.6	+ 0.9	+25.0	+ 6.2
Upper Mississippi	11	49.9	− 1.3	+14.4	+ 3.6
Missouri Valley	10	50.6	− 1.6	+17.2	+ 4.3
Northern Slope	7	45.4	+ 0.7	+ 9.7	+ 2.4
Middle Slope	6	53.6	− 0.5	+ 8.9	+ 2.2
Southern Slope	5	59.5	− 1.7	+ 9.1	+ 2.3
Southern Plateau	13	61.3	+ 4.3	+ 2.2	+ 0.6
Middle Plateau	9	51.0	+ 3.4	− 4.9	− 1.2
Northern Plateau	11	48.8	+ 2.4	+ 6.3	+ 1.6
North Pacific	9	48.9	+ 0.5	+ 3.5	+ 0.9
Middle Pacific	5	55.8	+ 1.3	− 2.1	− 0.5
South Pacific	4	61.8	+ 3.0	+ 1.1	+ 0.3

In Canada.—Prof. R. F. Stupart says:

The mean temperature for April was above the average in all portions of Canada, from Manitoba to our Atlantic Coast, except in the extreme southwestern portion of Ontario, and over and adjacent to the peninsula between the Georgian Bay and Lake Huron, where it was for the most part slightly below the average. In British Columbia it was average or a little above, while from the Rockies to the western border of Manitoba it was below average. The greatest amount below

average, 5°, was recorded at Swift Current; the next greatest amount below being 4°, at Medicine Hat. The station recording the greatest amount above average was Parry Sound, the excess being 4°.

PRECIPITATION.

Normal conditions.—Heavy precipitation in April (4 to 6 inches) occurs chiefly in the lower Mississippi Valley, Arkansas, eastern Texas, also portions of northern Florida, Georgia, and the coast region of North Carolina. A very narrow fringe of the north Pacific Coast also receives on the average from 4 to 5 inches of rainfall. The regions of moderate precipitation (2 to 4 inches) are much greater in extent than was the case in the preceding month. In addition to the areas then covered, viz, the lower Lake Region, the Ohio Valley, the Middle States, and New England, we may now include the upper Lake Region, the upper Mississippi Valley, the Missouri Valley below Yankton, and the Plains Region generally east of the one hundredth meridian. The normal rainfall of the northern Slope and northern Plateau is also slightly heavier in April than in March. Little or no rain falls over the Southwest, including in that designation western Texas, New Mexico, Arizona, the greater part of Utah, Nevada, and the desert region of southeastern California.

The current month.—On the whole, the current month must be classed as one of deficient rainfall. More than the normal amount of rain fell only in New England and the Middle Atlantic States and over the southern Plateau. The rainfall of the South Atlantic States and upper Mississippi Valley was exactly normal, and the fall of the remaining sixteen districts was below normal. The districts having the greatest deficiencies were south and middle Pacific, northern Plateau, east and west Gulf, and Florida Peninsula.

The drought in California and Florida, referred to in previous REVIEWS, continues unbroken. The rainfall of south-central Georgia, less than 300 miles from one of the drought stricken regions, was, however, the greatest that has been experienced in many months.

The distribution of precipitation was somewhat irregular, as may be seen by an examination of Chart III. In the great wheat and corn regions of the interior the amount averaged from 2 to 4 inches; in some portions of Missouri, Kansas, and Nebraska from 4 to 6 inches.

Averages and departures by districts are summarized for convenience of reference in the following table:

Average precipitation and departures from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		*Inches.*	*Inches.*
New England	10	4.80	145	+1.50	+2.30
Middle Atlantic	12	3.48	106	+0.20	−2.90
South Atlantic	10	3.38	100	0.00	−6.80
Florida Peninsula	7	1.29	56	−1.00	−6.00
East Gulf	7	2.93	66	−1.50	−7.50
West Gulf	7	2.30	59	−1.60	−2.00
Ohio Valley and Tennessee	12	2.58	65	−1.40	+0.80
Lower Lake	8	1.73	74	−0.60	+1.10
Upper Lake	9	1.37	58	−1.00	+0.70
North Dakota	7	1.47	75	−0.50	−0.70
Upper Mississippi	11	3.04	100	0.00	+3.30
Missouri Valley	10	2.84	93	−0.20	+0.80
Northern Slope	7	1.10	69	−0.50	−0.60
Middle Slope	6	1.89	95	−0.10	+0.50
Southern Slope	6	1.64	80	−0.40	−0.40
Southern Plateau	13	0.73	138	+0.20	−0.90
Middle Plateau	9	0.82	89	−0.10	−2.10
Northern Plateau	11	0.75	56	−0.60	−2.40
North Pacific	9	2.87	67	−1.40	−4.30
Middle Pacific	5	0.83	34	−1.60	−8.50
South Pacific	4	0.08	6	−1.20	−5.70

In Canada.—Professor Stupart says:

In eastern Quebec and throughout the Maritime Provinces precipitation was everywhere in excess of the average amount, and very considerably so in many portions of the latter Provinces. At St. John and Halifax it was exceeded by as much as 3 inches, at Grand Manan by 2.8 inches, Chatham by 2.6 inches, and Charlottetown by 2.1 inches. Father Point records the smallest amount above average, 0.3 inch, and Sydney comes next with 0.5 inch. Over all the large remaining portion of the Dominion the average amount was not reached, if we omit a small section of Assiniboia, and a few scattered localities in British Columbia, chiefly contiguous to the coast line, where the fall was up to or a little above the average amount. The deficiency was decidedly marked over large areas, and was strikingly so in the North Saskatchewan Valley, where no measurable amount occurred; also in the Lake Superior Region, where White River reports no measurable amount, and Port Arthur only 0.1 inch. In Manitoba, also, Brandon reports no rain, and the greatest amount reported from any place in that Province is 1.0 inch, and that from Winnipeg. At many places in Ontario the total precipitation for the month did not reach 1.0 inch, and in western Quebec the total amount recorded was also very small.

SNOWFALL.

The total snowfall for the current month is given in Tables I and II, and its geographic distribution is shown on Chart VIII. The snowfall of the month was rather light in all localities, especially in the mountain regions of the West. The greatest snowfall of the month, 33 inches, was recorded at Stamford, Colo. Ten inches and upward fell in portions of northern New England and the Canadian Maritime Provinces, and at mountain stations in California, Colorado, Montana, Oregon, and Utah.

Snow on ground at end of month.—There was practically no snow on the ground at the end of the month except at a few of the mountain stations in Montana, Colorado, California, Oregon, and Utah. The usual chart of snow on the ground at end of month has, therefore, been omitted.

Snowfall in the mountains.—Section Director Brandenburg, of the Colorado Climate and Crop Service, reports as follows:

The ground has been practically bare below timber line for some time prior to the stormy period which set in near the close of the month. In some parts of the mountain region the storm continued for a week, giving a considerable fall of snow, much of which was soon absorbed by the ground, but as a rule the amount of moisture was less than fell over the plains region. On the high ranges the depth of the snow is much less than a month ago, as might be expected from the advance of the season and the number of very warm days in April. In the following extracts from reports the depths, which are given in inches, are for the ranges or peaks in the vicinity of the different points:

Leadville, 24; Tennessee Pass, 12; Newett 12; Riverside, 30 at timber line, above which the snow is in drifts; St. Elmo, 24; Howard, 36; Coaldale, 45; Rosita, the Sangre de Cristo, has about one-half of its area in old snow, 30 inches deep on average; Winfield, 24, from April 28 to May 5, 40 inches fell; Beulah, none, except in canyons.

Boreas, 12; Farnham Summit, 12; Buffalo Springs, 12; Mountaindale and Hammond, none; Como, 12; Freeland, snow practically gone in Clear Creek County, outside of the main range, except in drifts on northern slope, the main range is apparently well supplied; Yankee, 60 fell in month; Moraine, snow in timber going very fast; Redbuttes, Wyo., 2; Manhattan, old snow all gone; Gleneyre, 4.

Wagon Wheel Gap, 12 on north hill sides, none on southern exposures; Alder, only in gulches and timber; Villa Grove, 10; Jasper, 18; Summitville, 36; Osier, only in drifts.

Alpine Tunnel, 50; Crested Butte, 15; Tolifero, none; Waunita, 8; Ruby, 24; Fulford, 36 above timber line, ground bare where a year ago snow was 3 feet deep.

Clarkson, only on north hillsides and in gulches, streams low; Fraser, a few drifts; Grand Lake, 24; Breckenridge, 30; Kokomo, 34, 5 of which is new; Ashcroft, 36, disappearing rapidly; Crystal, 30 in drifts, gulches, and slides, very little as compared with previous years.

HAIL.

The following are the dates on which hail fell in the respective States:

Alabama, 19. Arizona, 14, 17, 29, 30. California, 2, 18, 29, 30. Colorado, 16, 18, 19, 21, 27, 28, 29, 30. Delaware, 5, 27, 28. Georgia, 4, 22, 23, 26, 27. Idaho, 20, 22, 23, 26, 30. Illinois, 8, 9, 10, 17, 18, 24, 25, 26. Indiana, 9, 10, 12, 14. Iowa, 8, 17, 19, 25, 30. Kansas, 3, 5, 11, 12, 17, 18, 21, 29, 30. Kentucky, 9, 10, 12, 13, 16, 20. Louisiana, 4, 18, 19, 22, 23. Maryland, 5, 11, 24, 25, 28. Michigan, 10, 17, 18, 20. Minnesota, 19, 21, 25, 30. Mississippi, 4, 17, 18, 19, 23, 24. Missouri, 3, 4, 8, 17, 21, 22, 23, 24, 25. Montana, 17, 22, 23, 28.

Nebraska, 12, 17, 23, 30. Nevada, 20, 30. New Jersey, 10, 19, 21. New Mexico, 10, 11, 17, 24, 30. New York, 19, 21, 28. North Carolina, 4, 10, 13, 14, 25, 27. North Dakota, 9, 29. Ohio, 9, 10, 14, 17, 20. Oklahoma, 23, 29, 30. Oregon, 1, 6, 7, 18, 22, 26. Pennsylvania, 20, 26, 27. Rhode Island, 19, 28. South Carolina, 14, 19, 22, 24. South Dakota, 30. Tennessee, 4, 10, 13, 26. Texas, 12, 17, 18, 21, 22, 28, 29. Utah, 19, 29, 30. Virginia, 11, 28. Washington, 7, 22, 26, 30. West Virginia, 10, 20. Wisconsin, 9, 13, 20, 21. Wyoming, 11, 23, 29, 30.

The dates when hail was reported in the greatest number of States were: 30th, 15; 17th, 12; 19th, 11; 10th, 10.

SLEET.

The following are the dates on which sleet fell in the respective States:

California, 30. Connecticut, 19, 28, 29. Delaware, 28. Idaho, 7. Indiana, 5. Iowa, 18. Kansas, 2. Kentucky, 5. Maine, 6, 26, 28. Maryland, 5, 28. Massachusetts, 2, 19, 26, 28, 29. Michigan, 19, 20. Minnesota, 1, 9, 18, 19, 25. Missouri, 1. Montana, 7. New Hampshire, 2, 19, 20, 21, 28, 29. New Jersey, 2, 4, 5, 27, 28. New York, 2, 3, 5, 19, 20, 28. North Dakota, 27, 30. Ohio, 2, 20, 21. Oregon, 6, 7, 9, 26, 30. Pennsylvania, 21, 28, 29. Rhode Island, 28. South Carolina, 22, 29. South Dakota, 30. Tennessee, 4, 5, 14. Washington, 7. Wisconsin, 13, 18, 19.

The dates when sleet was reported in the greatest number of States were: 28th, 10; 19th, 7; 5th, 6; 2d, 6.

ICE AND NAVIGATION.

Interlake navigation opened this season much earlier than usual. The Straits of Mackinac were free from ice on March 28, the earliest date but one during the sixty-three years that records have been kept. The straits again filled with ice with the shifting of the wind, but vessels were able to work their passage through on April 2, the majority taking the north passage as the south channel was filled with solid pack ice until the second week in April. The first division of the grain fleet left Chicago on the afternoon of April 1, and arrived at Buffalo on April 4. Little difficulty was experienced from ice except in passing through the straits, the Lakes being remarkably free from ice for the season of the year. The passage into Green Bay was forced on April 11 by the *Ann Arbor No.* 1, in making Gladstone harbor. The steamers *Lockwood* and *Norfolk* were delayed several days by ice after getting into the bay.

The steamer *City of Paris* arrived at Sault Ste. Marie on April 14 and passed through the canal, opening navigation into Lake Superior on that date. The steamer *W. D. Rees* left Duluth for Washburn on April 11, and experienced considerable difficulty in working through the ice after reaching the bay.

HUMIDITY.

The humidity observations of the Weather Bureau are divided into two series; the first or tridaily series began in 1871 and ended with 1887; the second or twice-daily series is continuous from 1888 to the present time.

The monthly means of the second or present series are based upon observations of the whirled psychrometer at 8 a. m. and 8 p. m., seventy-fifth meridian time, which corresponds to 5 a. m. and 5 p. m., Pacific; 6 a. m. and 6 p. m., Mountain; and 7 a. m. and 7 p. m., Central standard time.

Mean values computed from the first series are naturally not directly comparable with those of the second. In general the means of the first series are lower than those of the second, since they include an observation in the afternoon when the relative humidity of the air is near the minimum of the day. At stations in the western plateau region, however, the converse holds good, the means of the second series being lower than those of the first by amounts ranging from 0 to 10 per cent on the average of the year.

In the present state of knowledge respecting the diurnal variation in the moisture of the air, we are scarcely warranted in combining the two series in a general mean.

The current month.—As will be seen by the detailed statement below the air was relatively drier than usual in the great majority of districts; it will also be noticed that the districts in which the air was relatively moist are in almost all cases the same as those in which an excess of precipitation occurred as would naturally be expected.

The normal for any district can be obtained by adding the departure to the average of the current month when the current humidity is below the normal (—), and subtracting it when it is above (+).

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	77	+ 5	Missouri Valley	62	— 3
Middle Atlantic	65	— 2	Northern Slope	56	— 1
South Atlantic	68	— 4	Middle Slope	56	+ 1
Florida Peninsula	70	— 5	Southern Slope	52	— 1
East Gulf	67	— 5	Southern Plateau	32	+ 2
West Gulf	71	— 1	Middle Plateau	45	+ 1
Ohio Valley and Tennessee	64	0	Northern Plateau	55	— 5
Lower Lake	66	— 4	North Pacific Coast	72	— 7
Upper Lake	70	— 4	Middle Pacific Coast	64	—10
North Dakota	64	— 4	South Pacific Coast	61	— 8
Upper Mississippi Valley	66	+ 1			

In using the table by means of which the amount of moisture in the air is computed from the readings of the wet and dry bulb thermometers, the pressure argument has almost always been neglected, an omission that has little significance except for low temperatures and at high stations, such as Santa Fe, El Paso, Cheyenne, and a few others. The failure to apply a correction for the influence of the prevailing pressure on the psychrometer has the effect of making the monthly means of relative humidity at high-level stations too small by quantities ranging from 5 to 10 per cent. In the application of the monthly averages of the above table, or those of individual stations in Table I, to special inquiries, whether in the departments of biology, climatology, or sanitary science, this fact should be kept in mind. It should also be remembered that the hours at which observations in the Rocky Mountain Plateau Region are made, viz, at 5 or 6 local mean time, morning and afternoon, give approximately the maximum and minimum values for the day; probably the means of such hours approach more nearly the true mean of the month than is the case on the Atlantic seaboard and in the seventy-fifth meridian time belt.

WIND.

High winds, local storms, and tornadoes.—Tornadoes of greater or less violence occurred on four days during the month as follows: On the 4th in Arkansas; 5th, Georgia and South Carolina; 22d, Texas and Georgia; 30th, Nebraska, South Dakota, Iowa, and Indian Territory. High winds (velocities of 50 miles per hour and over) occurred on various dates and in a number of localities, as shown in the table below.

The main facts concerning the tornadoes of the month are given in the chronological list which follows:

4th.—Stuttgart, Ark. (1½ mile northwest of), 1 a. m., local mean time; 2 persons injured; property loss, $5,000; path 300 yards wide, 3 to 4 miles long; moved to the northeast; funnel cloud. (Reported by Dr. H. A. Buerkle, voluntary Observer).

5th.—Friendship, Ga., about 11:30 p. m., central time; 1 person killed, 5 injured; property loss, $1,000; path $\frac{1}{4}$ mile wide, 2 miles long; moved northeast; funnel cloud. This storm appears to have lost the characteristics of a tornado soon after passing Friendship. When near Ellaville, about 10 miles northeast of Friendship, the wreckage appeared to indicate merely a straight-line gale.

Mr. Samuel P. Saltus, voluntary observer, Gillisonville, S. C., reports in some detail upon a minor tornado that was observed about 8 a. m., central time, three or four miles north of Ridgeland, Hampton County, S. C. The tornado moved to the eastward in a path about 4 miles in length and varying in width from 50 to 300 yards. Several buildings were destroyed, but no person was killed or severely injured. The greatest force of the storm seemed to be exerted at some distance above ground, as evidenced by the breaking off of trees and the unroofing of buildings.

22d.—Camilla, Mitchell County, Ga. (two miles north of), 9 a. m., central time, 2 persons injured; property loss about $1,000; path 75 yards wide, 3 or 4 miles long; moved a little east of north; funnel cloud.

A second tornado cloud was observed $1\frac{1}{4}$ mile from Abbeville in Wilcox County, Ga., about 80 miles due northeast of Camilla, at 11:30 a. m., central time. No casualties; three buildings destroyed; storm moved northeast through wooded section.

A third tornado cloud, moving parallel to and about 40 miles south of the Mitchell County storm, was said to have been observed in Thomas County. Further details are awaited.

Atlanta, Cook County, Tex., noon, central time, 2 persons killed, 1 injured; property loss about $2,000; path of destruction about 150 feet wide, $\frac{3}{4}$ mile long; moved northeast; funnel cloud.

30th.—A number of tornadoes were observed on the afternoon of the 30th in eastern Nebraska and northwestern Iowa. Probably the most destructive of all had its origin in Dixon County, Nebr. It crossed the Missouri three miles west of Elkpoint, S. Dak., passing thence northeasterly to Richland, S. Dak., and the Iowa border near Chatsworth in Plymouth County. Its movement after leaving Chatsworth is uncertain. A tornado appeared at Maurice, in Sioux County, however, in the direct course of the Chatsworth storm, at 4:45 p. m. The distance to Maurice from the Iowa border, where the tornado entered the State, is about 30 miles. The tornado entered the State about 3:40 p. m.; it is not improbable, therefore, that the Chatsworth and Maurice tornadoes were one and the same. The following special dispatch from Maurice and other remarks upon the tornadoes of this date are quoted from the April number of the Iowa Weather and Crop Service:

This town (Maurice) was visited by a destructive tornado at 4:45 last evening, but no fatalities resulted. The funnel-shaped cloud approached from the southwest. Its fearful roaring gave the citizens ample warning, and most of them had sought refuge in storm caves or cellars when the storm broke in its fury. In the northwestern part of town the most important structures leveled to the ground and totally destroyed are the following: Sioux City and Northern depot; Saint Paul and Kansas City Grain Company's elevators, valued at about $2,000, insured. Two dwelling houses and their contents were also destroyed.

The storm moved in a northeasterly course, passing through the southern portion of Sioux and diagonally through O'Brien County, expending its force at Hartley and vicinity. In O'Brien County, a few miles south of Sheldon, two children were killed, and numerous homes were wrecked. Heavy damage to buildings resulted in Hartley. The central line of this storm covered a distance of over 80 miles.

There were evidently a small group of tornadoes, moving on parallel lines, some distance apart, within the belt of disturbance. The little town of Carnes was struck about 4:50 p. m., and badly shattered buildings mark the pathway of the destroyer.

While the storm above described was sweeping through the counties of Plymouth, Sioux, and O'Brien, a similar disturbance passed on a parallel line, southwest to northeast, through the northern part of Monona (near Whiting), the southeastern part of Woodbury, across a corner of Ida, and through a portion of Buena Vista County. Much damage was wrought by this branch of the same general storm. A special from Oto to the Sioux City Journal said: "The storm began about 4:45 p. m., with a terrific rain and hail, and at 5:15 the dreaded funnel cloud was seen to be forming about a mile southeast of here, causing much alarm, carrying away small houses and overthrowing those somewhat larger, and moving even the largest buildings in its path."

The following description of the storm in Buena Vista County is furnished by David E. Hadden, voluntary observer at Alta. Mr. Hadden writes:

"A severe windstorm, which assumed some of the characteristics of a tornado, passed through a portion of Maple Valley and Nokomis townships, Buena Vista County, in the late afternoon of April 30, which resulted in considerable damage to barns, sheds, and other farm buildings. The sky was nearly overcast all forenoon, and partly cloudy in the afternoon of the 30th, with a brisk south to southwest wind. About 4:30 p. m. heavy clouds were observed in the southwest, with occasional murmurings of thunder. About 5 p. m. rain began, with some hail. This continued until 5:40 p. m., when rain and wind momentarily ceased, and heavy hail from $\frac{1}{2}$ to 2 inches in diameter began falling, lasting about five or six minutes. Just at this moment I observed the clouds, which were rather low, about 2 miles south of town, revolving quite rapidly (horizontally), and at intervals the suggestion of a funnel cloud would form about half way from the cloud to the ground, then quickly disperse, and again form and disperse. This was repeated several times, but at no time could the cloud be seen to reach the ground. I remarked to neighbors at the time that in all probability a tornado had just passed south of us. At 5:45 p. m. the wind suddenly ceased, but in a few minutes changed to northeast, then north and brisk northwest, accompanied by a very heavy rain, which continued until about 6:30 p. m.

"No lives were lost, or persons injured. But little electric disturbance was noted. About three-fourths of the hailstones were of the size of large marbles, and the rest were 1 to 2 inches in diameter. The location of débris at each farm proves that the storm was of the tornado type."

There appear to have been two groups of tornadoes having their origin in Dixon and Burt counties, Nebr., respectively. Both groups moved in parallel tracks almost due northeast, finally disappearing in Iowa about 6:30 p. m., after having covered about 115 miles. In all 6 persons were killed and probably 6 or 8 injured.

In addition to the tornadoes observed in Dixon and Burt counties a third tornado was seen at 2:09 p. m., central time, in the northwestern part of Lancaster County, Nebr., near the village of Agnew. Five buildings were destroyed in its course of 8 miles, and 2 persons were injured. The latter had fled to the cellar for safety, but were struck by heavy stones as the building was blown from over their heads. The property loss was $2,000.

A violent storm, having some of the characteristics of a tornado, struck Duncan, Ind. T., at 10:30 p. m., central time. One person was killed and 19 injured. The property loss was about $30,000; path of great destruction, $\frac{3}{4}$ mile wide and 3 miles long.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
		Miles				*Miles*	
Amarillo, Tex	3	64	w.	Fort Canby, Wash	8	50	se.
Do	4	54	n.	Do	21	52	s.
Do	21	66	w.	Do	22	59	s.
Block Island, R. I	27	50	ne.	Hatteras, N. C	27	68	n.
Do	28	72	ne.	Do	28	76	n.
Do	29	53	ne.	Huron, S. Dak	7	60	s.
Buffalo, N. Y	20	57	sw.	Do	26	50	s.
Columbia, Mo	13	60	nw.	Do	27	53	w.
Denver, Colo	29	58	sw.	Idaho Falls, Idaho	26	51	sw.
Dodge City, Kans	7	50	s.	Memphis, Tenn	13	50	w.
Eastport, Me	24	52	e.	Do	26	54	nw.
El Paso, Tex	3	51	w.	Oklahoma, Okla	30	50	s.
Do	12	52	ne.	Pierre, S. Dak	27	58	nw.
Do	21	56	w.	Pueblo, Colo	3	52	n.
Fort Canby, Wash	6	52	se.	Sault Ste. Marie, Mich.	19	50	se.
Do	7	60	se.	Williston, N. Dak	27	60	n.

SUNSHINE AND CLOUDINESS.

The quantity of sunshine, and therefore of heat, received by the atmosphere as a whole is very nearly constant from year to year, but the proportion received by the surface of the earth depends upon the absorption by the atmosphere, and varies largely with the distribution of cloudiness. The sunshine is now recorded automatically at 21 regular stations of the Weather Bureau by its photographic, and at 47 by its thermal effects. The photographic record sheets show the apparent solar time, but the thermometric records show seventy-fifth meridian time; for convenience the results are all given in Table IX for each hour of local mean time. In order to complete the record of the duration of cloudiness these registers are supplemented by special personal observations of the state of the sky near the sun for an hour after sunrise and before sunset, and the cloudiness for these hours has been added as a correction to the instrumental records, whence there results a complete record of the duration of sunshine from sunrise to sunset.

The average cloudiness of the whole sky is determined by numerous personal observations at all stations during the daytime, and is given in the column "average cloudiness" in Table I; its complement, or percentage of clear sky, is given in the last column of Table IX for the stations at which instrumental self-registers are maintained.

The percentage of clear sky (sunshine) for all of the stations included in Table I, obtained as described in the preceding paragraph, is graphically shown on Chart VII. The regions of cloudy and overcast skies are shown by heavy shading; an absence of shading indicates, of course, the prevalence of clear, sunshiny weather.

The formation of fog and cloud is primarily due to differences of temperature in a relatively thin layer of air next to the earth's surface. The relative position of land and water surfaces often greatly increases the tendency to form areas of cloud and fog. This principle is perhaps better exemplified in the Lake Region than elsewhere, although it is of quite general application. The percentage of sunshine on the lee shores of the Lakes is always much less than on the windward shores. Next to the permanent influences that tend to form fog and cloud may be classed the frequency of the passage of cyclonic areas.

The current month.—The month was generally one of diminished cloudiness and consequently of increased sunshine, particularly in North Dakota, western Montana, Idaho, Minnesota, and the Pacific Coast. Sunshine was below normal in New England and the Middle Atlantic States.

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	6.4	+1.1	Missouri Valley	5.0	−0.4
Middle Atlantic	6.0	+0.8	Northern Slope	5.1	−0.3
South Atlantic	4.2	−0.2	Middle Slope	4.7	+0.3
Florida Peninsula	3.0	−0.9	Southern Slope	4.2	0.0
East Gulf	3.9	−0.6	Southern Plateau	2.5	+0.2
West Gulf	4.6	−0.6	Middle Plateau	3.6	−0.9
Ohio Valley and Tennessee	5.3	0.0	Northern Plateau	4.9	−1.4
Lower Lake	5.7	+0.2	North Pacific Coast	5.8	−0.7
Upper Lake	5.1	−0.6	Middle Pacific Coast	4.1	−0.5
North Dakota	4.3	−1.2	South Pacific Coast	3.1	−0.8
Upper Mississippi Valley	5.1	−0.4			

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table IX, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

Thunderstorms.—The dates on which the number of reports of thunderstorms for the whole country were most numerous were: 17th, 149; 10th, 141; 24th, 131; 30th, 129.

Reports were most numerous from Missouri, 118; Kansas, 99; Arkansas, 91; Illinois, 81.

Auroras.—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz, from the 2d to the 10th, inclusive.

The greatest number of reports were received for the following dates: 12th, 32; 13th, 13; 14th, 23.

Reports were most numerous from North Dakota, 22; Minnesota, 14; New York, 9; Wisconsin, 8.

In Canada.—Auroras were reported as follows: Charlottetown, 13; Father Point, 6, 9, 10, 12, 14, 17, 22, 28; Quebec, 10, 12, 13, 14, 27; Montreal, 12, 13; White River, 15, 18; Minnedosa, 12, 15, 19, 23; Qu'Appelle, 12, 13; Banff, 11, 12, 18; Prince Albert, 14, 16, 19; Battleford, 1, 12, 14, 20, 28.

Thunderstorms were reported as follows: Toronto, 17; Swift Current, 23.

CLIMATE AND CROP SERVICE.

By JAMES BERRY, Chief of Climate and Crop Service Division.

The following extracts relating to the general weather conditions in the several States and Territories are taken from the monthly reports of the respective sections of the Climate and Crop Service. The name of the section director is given after each summary.

Rainfall is expressed in inches.

Alabama.—The mean temperature was 58.3°, or 6.4° below normal; the highest was 88°, at Ashville, Tuscaloosa, and Union Springs on the 30th, and the lowest, 25°, at Madison on the 6th and at Jasper on the 7th. The average precipitation was 4.44, or 0.64 above normal; the greatest monthly amount, 8.57, occurred at Warrior, and the least, 1.60, at Newton.—*F. P. Chaffee.*

Arizona.—The mean temperature was 62.4°; the highest was 113°, at Parker on the 25th, and the lowest, 19°, at Snowflake on the 1st. The average precipitation was 0.53; the greatest monthly amount, 2.50, occurred at Flagstaff, while none fell at several stations.—*W. T. Blythe.*

Arkansas.—The mean temperature was 59.2°, or 4.4° below normal; the highest was 93°, at Lutherville on the 30th, and the lowest, 19°, at Pond on the 6th. The average precipitation was 3.08, or 1.70 below normal; the greatest monthly amount, 7.85, occurred at Moore, and the least, 1.10, at Fulton.—*E. B. Richards.*

California.—The mean temperature was 60.9°, or 2.1° above normal the highest was 118°, at Volcano Springs on the 25th, and the lowest 9°, at Bodie on the 4th. The average precipitation was 0.41, or 1.62 below normal; the greatest monthly amount, 4.40, occurred at Cape Mendocino, while none fell at many stations.—*W. H. Hammon.*

Colorado.—The mean temperature was 45.7°, or 1.3° above normal; the highest was 90°, at Delta on the 26th, and the lowest, 5° below zero, at Breckenridge on the 4th. The average precipitation was 1.43, or about normal; the greatest monthly amount, 3.99, occurred at Stamford, and the least, 0.02, at Rangely.—*F. H. Brandenburg.*

Florida.—The mean temperature was 67.0°, or about 3.0° below normal; the highest was 95°, at Minneola Park on the 23d, 24th, and 25th, and the lowest, 34°, at Jasper, De Funiak Springs, and Wausau on the 8th. The average precipitation was 1.50, or considerably below normal; the greatest monthly amount, 7.45, occurred at De Funiak Springs, and the least, 0.12, at Kissimmee.—*A. J. Mitchell.*

Georgia.—The mean temperature was 59.4°, or 5.0° below normal; the highest was 89°, at Bainbridge on the 20th, at Macon on the 17th and at Piscola and Poulan on the 30th; the lowest was 25°, at Diamond on the 6th. The average precipitation was 4.49, or 1.16 above normal; the greatest monthly amount, 9.12, occurred at Marshallville, and the least, 2.17, at Waycross.—*J. B. Marbury.*

Idaho.—The mean temperature was 47.8°; the highest was 94°, at

Payette on the 24th, and the lowest, 4°, at Paris on the 1st. The average precipitation was 0.68; the greatest monthly amount, 2.13, occurred at Murray, and the least, 0.01, at Blackfoot.—*D. P. McCallum.*

Illinois.—The mean temperature was 49.6°, or about 3.0° below normal; the highest was 86°, at Golconda on the 30th, and the lowest, 15°, at Scales Mound on the 5th. The average precipitation was 3.26, or nearly normal; the greatest monthly amount, 5.70, occurred at Grayville, and the least, 0.76, at Chicago.—*C. E. Linney.*

Indiana.—The mean temperature was 49.5°, or 3.0° below normal; the highest was 85°, at Vevay on the 17th, and the lowest, 11°, at Winamac on the 5th. The average precipitation was 2.06, or 1.40 below normal; the greatest monthly amount, 4.16, occurred at Mount Vernon, and the least, 0.35, at Hammond.—*C. F. R. Wappenhans.*

Iowa.—The mean temperature was 48.1°, or about normal; the highest was 91°, at Carroll, Glenwood, Logan, Portsmouth, and Ogden on the 16th, and the lowest, 14°, at Rock Rapids on the 5th. The average precipitation was 2.56, or nearly normal; the greatest monthly amount, 4.82, occurred at Moorar, and the least, 0.27, at Larchwood.—*G. M. Chappel.*

Kansas.—The mean temperature was 53.7°, or 2.2° below normal; the highest was 93°, at Achilles on the 15th and at Dresden on the 16th, and the lowest, 10°, at Eureka and Hoxie on the 2d. The average precipitation was 3.10, or 0.45 above normal; the greatest monthly amount, 8.11, occurred at Campbell, and the least, 0.25, at Ulysses.—*T. B. Jennings.*

Kentucky.—The mean temperature was 52.4°, or 5.0° below normal; the highest was 86°, at Paducah on the 30th, and the lowest, 19°, at Ashland on the 6th. The average precipitation was 3.38, or 0.80 below normal; the greatest monthly amount, 5.55, occurred at Henderson, and the least, 1.08, at Carrollton.—*G. E. Hunt.*

Louisiana.—The mean temperature was 62.9°, or about 5.0° below normal; it was the coolest April on record; the highest was 89°, at Como on the 17th, at Liberty on the 18th, at Jeanerette on the 19th, and at White Sulphur Springs on the 22d; the lowest was 28°, at Robeline on the 7th. The average precipitation was 3.04, or about 1.00 below normal; the greatest monthly amount, 5.67, occurred at Bastrop, and the least, 0.80, at Venice.—*R. E. Kerkam.*

Maryland and Delaware.—The mean temperature was 49.4°, or 3.4° below normal; the highest was 88°, at Ocean City, Md., on the 18th, and the lowest, 6°, at Deerpark, Md., on the 6th. The average precipitation was 2.91, or 0.43 below normal; the greatest monthly amount, 5.65, occurred at Sunnyside, Md., and the least, 0.57, at Hagerstown, Md.—*F. J. Walz.*

Michigan.—The mean temperature was 42.3°, or 1.5° below normal; the highest was 79°, at Mottville on the 17th, and the lowest, 3° below zero, at Sidnaw on the 5th. The average precipitation was 1.66, or 0.71 below normal; the greatest monthly amount, 3.58, occurred at Northport, and the least, 0.19, at Rockland.—*C. F. Schneider.*

Minnesota.—The mean temperature was 43.5°, or about 1.0° below normal; the highest was 87°, at Montevideo on the 15th, and the lowest, zero, at Koochiching on the 3d. The average precipitation was 1.64, or about 1.00 below normal; the greatest monthly amount, 6.29, occurred at Bingham Lake, and the least, 0.32, at St. Cloud.—*T. S. Outram.*

Mississippi.—The mean temperature was 60.0°, or 4.7° below normal; the highest was 96°, at Burke on the 24th, and the lowest, 25°, at French Camp on the 7th. The average precipitation was 3.32, or 3.11 below normal; the greatest monthly amount, 5.22, occurred at Water Valley, and the least, 1.35, at Mosspoint.—*R. J. Hyatt.*

Missouri.—The mean temperature was 52.5°, or 3.8° below normal; the highest was 90°, at Malden on the 30th, and the lowest, 14°, at Potosi on the 7th. The average precipitation was 3.63, or 0.30 below normal; the greatest monthly amount, 6.65, occurred at Sublett, and the least, 0.87, at Zeitonia.—*A. E. Hackett.*

Montana.—The mean temperature was 44.0°, or slightly above normal; the highest was 89°, at Augusta on the 25th, and the lowest, 13° below zero, at Kipp on the 1st. The average precipitation was 1.04, or 0.03 above normal; the greatest monthly amount, 3.10, occurred at Dearborn Canyon, and the least, 0.10, at Radersburg.—*J. Warren Smith.*

Nebraska.—The mean temperature was 48.0°, or about 2.0° below normal; the highest was 98°, at Benkelman on the 15th, and the lowest, 5°, at Callaway on the 6th. The average precipitation was 2.14, or 0.71 below normal; the greatest monthly amount, 5.80, occurred at Wilber, and the least, 0.10, at Lodgepole.—*G. A. Loveland.*

Nevada.—The mean temperature was 51.1°, or about 3.0° above normal; the highest was 103°, at St. Thomas on the 26th, and the lowest, 12°, at Elko on the 1st and at Tuscarora on the 2d. The average precipitation was 0.71, or 0.26 above normal; the greatest monthly amount, 2.50, occurred at Tecoma, while none fell at several stations.—*R. F. Young.*

New England.—The mean temperature was 42.0°, or 1.8° below normal; the highest was 78°, at North Grosvenor Dale, Conn., on the 18th, and the lowest, 5°, at Mayfield, Me., and Berlin Mills, N. H., on the 4th. The average precipitation was 4.17, or 1.39 above normal; the greatest monthly amount, 8.47, occurred at Cohasset, Mass., and the least, 1.89, at Cornwall, Vt.—*J. W. Smith.*

New Jersey.—The mean temperature was 45.8°, or 1.8° below normal; the highest was 81°, at Vineland on the 23d, and the lowest, 13°, at Franklin Furnace on the 13th, and at Charlotteburg on the 14th. The average precipitation was 3.74, or 0.40 above normal; the greatest monthly amount, 4.94, occurred at Rivervale, and the least, 2.17, at Franklin Furnace.—*E. W. McGann.*

New Mexico.—The mean temperature was 54.9°, or about 1.0° above normal; the highest was 98°, at San Marcial on the 26th, and the lowest, 10°, at Fort Union on the 5th. The average precipitation was 0.99, or about 0.50 above normal; the greatest monthly amount, 2.17, occurred at Fort Union, and the least, 0.16, at Lordsburg.—*R. M. Hardinge.*

New York.—The mean temperature was 42.8°, or 0.8° below normal; the highest was 82°, at Cedarhill on the 17th, and the lowest, 2° below zero, at Number Four on the 5th. The average precipitation was 2.67, or 0.15 above normal; the greatest monthly amount, 5.90, occurred at Brentwood, and the least, 0.83, at Ogdensburg.—*R. G. Allen.*

North Carolina.—The mean temperature was 54.1°, or about 4.0° below normal; the highest was 90°, at Newbern on the 19th, and the lowest, 15°, at Linnville on the 6th. The average precipitation was 3.70, or about normal; the greatest monthly amount, 6.60, occurred at Lumberton, and the least, 2.32, at Morganton.—*C. F. von Herrmann.*

North Dakota.—The mean temperature was 42.1°, or 0.7° above normal; the highest was 87°, at Minot on the 18th, and the lowest, 4° below zero, at Berthold Agency on the 1st. The average precipitation was 1.51, or 1.17 below normal; the greatest monthly amount, 4.16, occurred at University, and the least, 0.15, at Towner.—*B. H. Bronson.*

Ohio.—The mean temperature was 47.2°, or 3.0° below normal; the month was the coolest April in sixteen years; the highest was 87°, at Thurman on the 30th, and the lowest, 10°, at Medina on the 3d. The average precipitation was 2.38, or 0.60 below normal; the greatest monthly amount, 4.54, occurred at Lancaster, and the least, 0.85, at Jacksonboro.—*H. W. Richardson.*

Oklahoma.—The mean temperature was 58.2°; the highest was 96°, at Arapaho on the 27th, and the lowest, 18°, at Putnam on the 4th. The average precipitation was 1.52; the greatest monthly amount, 5.86, occurred at Fort Sill, and the least, 0.44, at Kingfisher.—*J. I. Widmeyer.*

Oregon.—The mean temperature was 50.1°, or 2.4° above normal; the highest was 92°, at Prineville on the 28th, and the lowest, 8°, at Silverlake on the 3d. The average precipitation was 1.78, or 1.38 below normal; the deficiency was general over the entire State; the greatest monthly amount, 8.85, occurred at Bay City, and the least, trace, at Burns.—*B. S. Pague.*

Pennsylvania.—The mean temperature was 45.6°, or 2.2° below normal; the highest was 84°, at Greensboro on the 24th, and the lowest, 4°, at Dushore on the 3d. The average precipitation was 2.93, or 0.37 below normal; the greatest monthly amount, 5.34, occurred at Swiftwater, and the least, 1.36, at Chambersburg.—*T. F. Townsend.*

South Carolina.—The mean temperature was 58.0°, or 4.8° below normal; the highest was 92°, at Shaws Fork on the 30th, and the lowest, 25°, at Central on the 7th. The average precipitation was 5.05, or 1.91 above normal; the greatest monthly amount, 7.61, occurred at Edisto, and the least, 2.48, at Charleston.—*J. W. Bauer.*

South Dakota.—The mean temperature was 45.7°, or about normal; the highest was 92°, at Cherry Creek on the 15th and 26th, and at Pierre on the 15th, and the lowest, 3° below zero, at Rockford on the 1st. The average precipitation was 1.44, or 0.97 below normal; the greatest monthly amount, 3.35, occurred at Montrose, and the least, 0.10, at Forest City.—*S. W. Glenn.*

Tennessee.—The mean temperature was 53.4°, or about 6.0 below normal; the highest was 88°, at Brownsville on the 30th, and the lowest, 15°, at Silverlake on the 6th. The average precipitation was 4.19, or slightly below normal; the greatest monthly amount, 7.22, occurred at Tracy City, and the least, 2.54, at Springdale.—*H. C. Bate.*

Texas.—The mean temperature for the State, determined by comparison of 38 stations distributed throughout the State, was 3.0° below the normal. There was a slight excess over west Texas and in the vicinity of Camp Eagle Pass, while there was a general deficiency over the other portions of the State. The highest was 101°, at Fort Ringgold on the 23d and 24th, and the lowest, 20°, at Valentine on the 5th. The precipitation on an average for the State during the month, determined by comparison of 39 stations distributed throughout the State, was 0.40 below the normal. Nearly normal conditions prevailed over west Texas, the panhandle, and the western portion of the coast district. There was a general deficiency ranging from about 1.00 to 3.31 over east, southwest, and north Texas, and the northern portion of central Texas, with the greatest deficiency in the vicinity of Tyler, while over the central and east portions of the coast district and the southern portion of central Texas there was a general excess, with the greatest, 3.55, in the vicinity of Burnet. The greatest monthly amount, 6.83, occurred at Burnet, and the least, 0.09, at Mount Blanco.—*I. M. Cline.*

Utah.—The mean temperature was 51.5°; the highest was 98°, at St. George on the 26th, and the lowest, 8°, at Loa on the 4th. The average precipitation was 0.72, or below normal; the greatest monthly amount, 1.58, occurred at Logan, and the least, 0.15, at Richfield.—*J. H. Smith.*

Virginia.—The mean temperature was 51.4°, or several degrees below

normal; the highest was 97°, at Leesburg on the 19th, and the lowest, 12°, at Dale Enterprise on the 6th. The average precipitation was 3.66, or 0.63 above normal; the greatest monthly amount, 8.15, occurred at Hampton, and the least, 1.56, at Manassas.—*E. A. Evans.*

Washington.—The mean temperature was 49.3°, or about 1.5° above normal; the highest was 85°, at Lind on the 25th, and the lowest, 19°, at Ellensburg on the 7th. The average precipitation was 1.88, or over 1.50 below normal; the greatest monthly amount, 8.44, occurred at Clearwater, and the least, trace, at Bridgeport and Lakeside.—*G. N. Salisbury.*

West Virginia.—The mean temperature was 48.0°, or about 4.0° below normal; the highest was 86°, at Eastbank on the 17th, and the lowest, 2°, at Dayton on the 6th. The average precipitation was 3.14, or about 0.25 below normal; the greatest monthly amount, 4.86, occurred at Morgantown, and the least, 1.40, at Huntington.—*C. M. Strong.*

Wisconsin.—The mean temperature was 43.5°, or 1.3° below normal; the highest was 84°, at Brodhead on the 16th, and the lowest, 4°, at Florence on the 5th and at Oceola on the 2d. The average precipitation was 2.42, or 0.59 below normal; the greatest monthly amount, 4.51, occurred at Neillsville, and the least, 0.40, at Bayfield.—*W. M. Wilson.*

Wyoming.—The mean temperature was 44.3°, or 3.5° above normal; the highest was 90°, at Ft. Laramie on the 27th, and the lowest, zero, at Four Bear on the 1st. The average precipitation was 0.93, or 0.60 below normal; the greatest monthly amount, 2.03, occurred at Carbon, and the least, 0.15, at Lowell.—*W. S. Palmer.*

RIVER AND FLOOD SERVICE.

By PARK MORRILL, Forecast Official, in charge of River and Flood Service.

The flood in the lower Mississippi culminated at Cairo on the 6th at a stage of 49.8 feet; during the rest of the month the river fell steadily at this point, except for a slight rise in the last two days. At Memphis the highest water of record, 37.3 feet, was reached on the 11th and 12th. The great height of water at this point, notwithstanding the fact that the flood was not very destructive, is to be explained by the fact that the levees in front of the St. Francis bottom remained nearly intact, and thus forced a large volume of water to descend the channel which, in the past, has passed through the St. Francis swamps. That the volume of flood water was not exceptionally large is shown by the comparatively moderate stage reached at Vicksburg, where the crest was attained on the 24th and 25th at a stage of 49.4 feet.

The great flood wave in the Ohio rapidly subsided during the first ten days of the month. The high water in the Missouri and Arkansas, at the beginning of the month, also soon decreased to the usual low stages. During the latter half of the month all the great tributaries of the Mississippi were at their normal heights, and the danger of flood may now be regarded as past.

The highest and lowest water, mean stage, and monthly range at 117 river stations are given in the accompanying table. Hydrographs for typical points on seven principal rivers are shown on the chart. The stations selected for charting are: Keokuk, St. Louis, Cairo, Memphis, and Vicksburg, on the Mississippi; Cincinnati, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.

For fuller details see Monthly Bulletin of the River and Flood Service for April, 1898.

Heights of rivers above zeros of gauges, April, 1898.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Mississippi River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
St. Paul, Minn	1,957	14	4.1	15, 16	3.0	27-30	3.7	1.1
Reeds Landing, Minn	1,887	12	3.4	2	2.7	12, 13	3.1	0.7
La Crosse, Wis	1,822	10	5.1	2, 3, 27, 28	4.2	13, 16	4.7	0.9
North McGregor, Iowa	1,762	18	6.0	30	4.4	15-18	5.2	1.6
Dubuque, Iowa	1,702	15	5.7	6, 7, 30	4.4	16-18	5.1	1.3
Leclaire, Iowa	1,612	10	3.9	8, 9	3.1	18, 19	3.5	0.8
Davenport, Iowa	1,596	15	5.0	8, 9	4.1	18, 19	4.6	0.9
Galland, Iowa	1,475	8	3.0	1	2.4	22	2.7	0.6
Keokuk, Iowa	1,466	14	5.1	14	3.8	22	4.5	1.3
Hannibal, Mo	1,405	17	7.6	15	5.2	22	6.0	2.4
Grafton, Ill	1,307	23	15.5	1	10.0	30	12.5	5.5
St. Louis, Mo	1,264	30	22.8	1	13.5	24	17.1	9.3
Chester, Ill	1,189	30	20.4	1	10.2	25	13.8	10.2
Cairo, Ill	1,073	40	49.8	6	27.0	27	39.8	22.8
Memphis, Tenn	843	33	37.3	11, 12	20.7	29	32.3	16.6
Helena, Ark	767	44	49.1	17	35.0	30	44.7	14.1
Arkansas City, Ark	635	42	51.2	19-21	43.0	1	48.8	8.2
Greenville, Miss	595	40	46.2	21	36.5	1	43.2	9.7
Vicksburg, Miss	474	41	49.4	24, 25	39.4	1	46.4	10.0
New Orleans, La	108	16	16.9	27, 28	13.4	1	15.6	3.5

Heights of rivers above zeros of gauges—Continued.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Arkansas River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Wichita, Kans	720	10	2.7	30	1.2	2, 4-12, 15-17	1.5	0.5
Fort Smith, Ark	345	22	14.3	1	4.6	19	7.3	9.7
Dardanelle, Ark	250	21	16.7	1	5.0	18, 19	8.2	11.7
Little Rock, Ark	170	23	21.0	1	7.0	20	11.0	14.0
White River.								
Newport, Ark	150	26	30.7	1	13.1	29, 30	20.6	17.6
Des Moines River.								
Des Moines, Iowa	150	19	4.4	19-23	4.1	1, 10, 14-17	4.2	0.3
Illinois River.								
Peoria, Ill	135	14	19.2	1	10.9	30	14.4	8.3
Missouri River.								
Bismarck, N. Dak	1,201	14	10.7	15	3.5	11	5.7	7.2
Pierre, S. Dak	1,006	14	8.7	17	1.8	14	4.3	6.9
Sioux City, Iowa	676	19	12.7	20	5.9	16	7.7	6.8
Omaha, Nebr	561	18	12.3	21	6.4	5-7, 12, 17-19	7.8	5.9
St. Joseph, Mo	373	10	7.6	23	1.3	1, 2	3.3	6.3
Kansas City, Mo	280	21	14.2	24	6.4	2	8.7	7.8
Boonville, Mo	191	20	12.6	25	6.6	5, 20-23	8.2	6.0
Hermann, Mo	95	24	13.1	1	6.8	22	9.2	6.3
Ohio River.								
Pittsburg, Pa	966	22	13.5	26	3.9	23	6.9	9.6
Davis Island Dam, Pa	960	25	13.2	27	5.9	23	8.4	7.3
Wheeling, W. Va	875	36	23.0	1	7.0	23	10.7	16.0
Parkersburg, W. Va	785	35	26.2	1	8.5	24	12.9	17.7
Point Pleasant, W. Va	703	36	39.0	1	9.0	25	16.9	30.0
Catlettsburg, Ky	651	50	47.5	1	12.3	25	21.8	35.2
Portsmouth, Ohio	612	50	50.5	1	13.8	25	23.3	36.7
Cincinnati, Ohio	499	45	56.5	1	16.5	27	27.1	40.0
Louisville, Ky	367	24	35.0	1	7.8	28	13.3	27.2
Evansville, Ind	184	30	44.8	2, 3	16.1	30	28.0	28.7
Paducah, Ky	47	40	47.3	6	19.6	27	33.7	27.7
Alleghany River.								
Warren, Pa	177	7	6.8	25	1.4	19-21	2.8	5.4
Oil City, Pa	123	13	6.8	25	1.8	20	3.4	5.0
Parkers Landing, Pa	73	20	7.7	25	1.5	18-20	3.2	6.2
Freeport, Pa	26	20	11.1	1, 26	3.5	20-22	5.8	7.6
Conemaugh River.								
Johnstown, Pa	64	7	4.1	1	2.0	14, 19, 22, 23	2.5	2.1
Red Bank Creek.								
Brookville, Pa	35	8	1.6	1	0.4	12-23	0.8	1.2
Beaver River.								
Ellwood Junction, Pa	10	14	3.0	25	1.2	19	1.7	1.8
Cumberland River.								
Burnside, Ky	434	50	14.8	15	5.6	24	8.9	9.2
Carthage, Tenn	257	30	17.1	17	8.9	27	12.6	8.2
Nashville, Tenn	175	40	23.3	1	12.9	28	17.8	10.4
Great Kanawha River.								
Charleston, W. Va	61	30	17.0	1	5.3	24	7.7	11.7
New River.								
Hinton, W. Va	95	14	6.0	1	2.2	24	3.4	3.8
Licking River.								
Falmouth, Ky	30	25	6.8	1	2.6	12, 13	3.6	4.2
Miami River.								
Dayton, Ohio	69	18	4.7	1	2.3	23	2.9	2.4
Monongahela River.								
Weston, W. Va	161	18	6.0	26	—0.9	12	0.7	6.9
Fairmont, W. Va	119	25	12.6	26	1.7	23	4.2	10.9
Greensboro, Pa	81	18	15.5	26	8.1	9, 10, 23, 24	9.8	7.4
Lock No. 4, Pa	40	28	20.0	26	8.3	24	11.1	11.7
Cheat River.								
Rowlesburg, W. Va	36	14	5.0	1, 2	3.0	10, 11, 30	4.1	2.0
Youghiogheny River.								
Confluence, Pa	59	10	4.8	16	1.8	29, 30	2.8	3.0
West Newton, Pa	15	23	5.9	16	1.7	12, 14, 24	2.8	4.2
Muskingum River.								
Zanesville, Ohio	70	20	19.5	26	8.4	14, 19, 20	10.6	11.1
Tennessee River.								
Knoxville, Tenn	614	29	....	....	....	....	....	....
Kingston, Tenn	534	25	12.2	1	2.8	26	5.0	9.4
Chattanooga, Tenn	430	33	18.0	2	6.5	26, 27	9.4	11.5
Bridgeport, Ala	390	24	13.7	2	5.0	23, 24, 27	7.6	8.7
Florence, Ala	220	16	11.5	4	5.9	29, 30	8.3	5.6
Johnsonville, Tenn	94	21	21.7	7	9.4	30	15.3	12.3

Heights of rivers above zeros of gauges—Continued.

Stations.	Distance to mouth of river.	Danger-line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Clinch River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Speers Ferry, Va	156	20	5.6	1	0.4	30	1.7	5.2
Clinton, Tenn	46	25	16.0	1	4.8	30	8.8	11.2
Wabash River.								
Mount Carmel, Ill	50	15	26.6	1	6.4	24	13.6	20.2
Red River.								
Arthur City, Tex	688	27	16.1	1	3.3	16, 17, 19, 20	6.1	12.8
Fulton, Ark	565	28	22.9	1	5.0	22	11.2	17.9
Shreveport, La	449	29	13.1	7	5.4	26	9.3	7.7
Alexandria, La	139	33	15.1	8,9	7.8	30	1.2	7.3
Atchafalaya Bayou.								
Melville, La	100*	31	33.9	29,30	29.7	1	32.2	4.2
Ouachita River.								
Camden, Ark	340	39	18.0	1	5.9	22	9.6	12.1
Monroe, La	100	40	19.8	30	13.5	18	16.5	6.3
Yazoo River.								
Yazoo City, Miss	80	25	24.4	26-28	14.9	1	20.9	9.5
Chattahoochee River.								
Columbus, Ga	140	20	13.0	6	1.7	19	4.4	11.3
Flint River.								
Albany, Ga	80	20	7.0	10	1.2	1,5	3.2	5.8
Cape Fear River.								
Fayetteville, N. C	100	38	21.5	7	3.9	23	8.7	17.6
Columbia River.								
Umatilla, Oreg	270	25	12.5	30	0.0	1	7.3	12.5
The Dalles, Oreg	166	40	21.3	29,30	5.3	1,2	12.1	16.0
Willamette River.								
Albany, Oreg	99	20	5.5	11, 16	3.8	2,6	4.6	1.7
Portland, Oreg	10	15	11.3	30	2.5	3	6.9	8.8
Edisto River.								
Edisto, S. C	75	6	4.8	29,30	2.6	1	3.8	2.2
James River.								
Lynchburg, Va	257	18	5.4	1	1.3	30	2.8	4.1
Richmond, Va	110	12	4.5	1	0.7	23	1.9	3.8
Alabama River.								
Montgomery, Ala	265	35	20.2	7,8	3.7	19, 20	9.8	16.5
Selma, Ala	212	35	23.0	8,9	4.7	21	11.9	18.3
Coosa River.								
Rome, Ga	225	30	17.2	6	3.0	17-19, 23	5.6	14.2
Gadsden, Ala	144	18	15.8	7,8	3.3	18	7.6	13.5

Heights of rivers above zeros of gauges—Continued.

Stations.	Distance to mouth of river.	Danger line on gauge.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
Tombigbee River.	*Miles.*	*Feet.*	*Feet.*		*Feet.*		*Feet.*	*Feet.*
Columbus, Miss	285	33	12.3	24	0.6	18	5.9	11.7
Demopolis, Ala	155	35	32.9	7	9.3	20	23.9	23.6
Black Warrior River.								
Tuscaloosa, Ala	90	38	38.7	6	8.1	19	20.8	30.6
Pedee River.								
Cheraw, S. C	145	27	22.1	1	1.7	23	5.7	20.4
Black River.								
Kingstree, S. C	60	12	5.1	15-18	3.1	4	4.2	2.0
Lumber River.								
Fairbluff, N. C	10	6	3.9	30	1.1	1	2.8	2.8
Lynch Creek.								
Effingham, S. C	35	12	9.0	30	3.6	2	5.5	5.4
Potomac River.								
Harpers Ferry, W. Va	170	16	8.9	17	2.9	12-15, 26-28	3.9	6.0
Roanoke River.								
Clarksville, Va	155	12	2.2	27	0.6	21, 22	1.2	1.6
Sacramento River.								
Redbluff, Cal	241	23	1.2	7-25	1.0	1-6	1.1	0.2
Sacramento, Cal	70	25	14.3	16-19, 27	12.5	1,6	13.5	1.8
Santee River.								
St. Stephens, S. C	50	12	8.2	15, 16	1.7	1	6.6	6.5
Congaree River.								
Columbia, S. C	37	15	5.6	6	1.3	21-23	2.5	4.3
Wateree River.								
Camden, S. C	45	24	22.0	1	3.5	23	7.7	18.5
Savannah River.								
Augusta, Ga	130	32	18.0	7	6.8	23	10.0	11.2
Susquehanna River.								
Wilkesbarre, Pa	178	14	13.5	26	1.0	18, 22, 23	4.2	12.5
Harrisburg, Pa	70	17	10.3	27	3.0	24	5.0	7.3
Juniata River.								
Huntingdon, Pa	80	24	5.5	1	3.9	12-23	4.2	1.6
W. Br. of Susquehanna.								
Williamsport, Pa	35	20	8.7	26	2.7	14, 15	4.5	6.0
Waccamaw River.								
Conway, S. C	40	7	2.9	9	1.7	4, 20, 26	2.2	1.2

*Distance to Gulf of Mexico.

SPECIAL CONTRIBUTIONS.

A VISIT TO THE HIGHEST METEOROLOGICAL STATION IN THE WORLD.

By ROBERT DEC. WARD, Instructor in Climatology, Harvard University. (Dated May 21, 1898.)

The highest meteorological station in the world is situated at an altitude of 19,200 feet on the summit of El Misti, a quiescent volcano near the city of Arequipa, Peru. This is one of a series of eight meteorological stations operated, in connection with the Harvard College Observatory, at Arequipa. The names and altitudes of the several stations are as follows: Mejia, 55 feet; La Joya, 4,141; Arequipa, 8,050; Pampa de los Huesos, 13,400; Misti, base, 15,700; Misti, summit, 19,200; Cuzco, 11,378; Echarati, 3,300. These places are roughly in a south-north line, and extend from the seacoast across both ranges of the Cordillera and down to Echarati, lying in a valley at the head of the Amazon River system.

The establishment of an astronomical and meteorological observatory at Arequipa, and of the seven other meteorological stations which are now operated in connection with it, was the result of a bequest left to the Harvard College Observatory in 1887 by the will of Mr. Uriah A. Boyden. The terms of the will were that the money should be used in establishing an observatory "at such an elevation as to be free, so far as practicable, from the impediments to accurate observation which occur in the observatories now existing, owing to atmospheric influences." Owing to the remarkable clearness and steadiness of the air at Arequipa it was decided, after a careful study of the meteorological conditions in other places, that the permanent observatory should be located here, and the buildings were erected in 1891. Arequipa is about 80 miles from the Pacific Ocean, in latitude 16° 22′ 28″ S., longitude $4^h\ 46^m\ 12^s$, and about in the middle of the long desert belt which stretches along the west coast of South America from latitude 4° to 30° S.

The small snowfall and comparatively high temperatures on the mountains of Peru offer exceptional opportunities for the establishment of meteorological stations at great altitudes, and since 1892 Harvard University has had the credit of maintaining in Peru the highest meteorological station in the world. In that year a station with ordinary and self-recording meteorological instruments was placed, by Prof. Wm. H. Pickering, at an elevation of 16,650 feet on Charchani, an extinct volcano 20,000 feet high, situated 12 miles north of Arequipa. The exposure of the instruments, however, was not favorable, owing to the fact that the station was in a somewhat sheltered position on the flank of the mountain, and in October, 1893, Prof. Solon I. Bailey, then in charge of the Arequipa Observatory, succeeded in establishing a new station on the summit of the Misti. This station is about 3,500 feet higher than the one on Mont Blanc, and is therefore the highest meteorological station in the world. The shape of the Misti is that of an almost perfect, although more or less truncated, cone, and the conditions of exposure of the instruments are as nearly perfect as it is possible to obtain on a mountain.

The instruments now in use on the summit are dry and wet bulb and maximum and minimum thermometers, rain-gauge, Richard barograph, thermograph, and hygrograph. There is also a meteorograph, constructed by Fergusson, of Blue Hill Observatory, especially for this station, and designed to record temperature, pressure, humidity, and wind direction and velocity, and to run three months without rewinding. This meteorograph has not yet given quite as complete records as it was originally hoped would be obtained

from it. Since its establishment the Misti station has been regularly visited by the observers from Arequipa, at first, and for many months, once in ten days, and since then about once a month. On these visits the clocks of the self-recording instruments are rewound, the record sheets changed, and check readings of all the instruments are made. The trip to the summit is by no means an easy one, and the altitude of the Misti is so great that almost everyone going up suffers from *soroche*, or mountain sickness. Although it has thus far been impossible, in view of the great altitude and the distance of the Misti station, to secure complete and continuous records from it, still the broken records which have been obtained are so interesting that this, to a considerable extent, makes up for their fragmental character.

The writer visited the Misti station twice during a recent stay of three months in Arequipa, and he has thought that it might interest the readers of the MONTHLY WEATHER REVIEW to know something of the physiological effects of the high altitude which these trips produced in his own case.

The trip from the observatory at Arequipa to the top of the Misti and back occupies two days, and is accomplished entirely on mule-back. The start from the observatory is made at 6 or 7 o'clock in the morning, each member of the party, including the guide, riding a mule, and one or two pack-mules being taken along to carry fodder for the use of the animals on the way, for the road is over barren, sandy deserts where nothing grows. Toward noon of the first day a stop is made to water the animals at a small spring—a great rarity in these dry regions—and at which many trains of pack-mules and llamas, winding their way across the pampa toward Arequipa, stop for water. About 3 or 4 in the afternoon a short stop is made on the Pampa de los Huesos, where the instrument shelter is visited, the clocks are rewound, the sheets changed, and check readings of the instruments made. The latter are wet and dry bulb thermometers and Richard barograph and thermograph. The Huesos station is on a pampa composed of volcanic sand and ashes, lying at the base of the Misti. This pampa is almost completely barren, and as there is no possibility of securing an observer here, readings of the instruments are made whenever a trip is made to the summit of the Misti.

The night is spent in a hut at the base of the mountain, at an altitude of 15,700 feet above sea level. Here is the next station, known as the "Mont Blanc" station, because its altitude and that of the summit of Mont Blanc are almost exactly the same. The "M. B." shelter, as it is called for brevity, is at a distance of about 200 feet from the hut. The instruments are wet and dry bulb and maximum and minimum thermometers, thermograph, and barograph, and this station is visited, as is that on the Pampa de los Huesos, when an expedition is made to the summit. The ascent from the hut to the summit occupies four or five hours, the descent to the hut about an hour and a half, and the ride back to Arequipa five hours more. It is, of course, an extremely fortunate circumstance that no physical exertion need be made in the ascent, for if persons unaccustomed to climbing at high altitudes were obliged to go on foot up the mountain, they would doubtless suffer severely from mountain sickness, for it is well known that exercise always increases the disagreeable symptoms of this malady. The mules that make the ascent all suffer more or less from shortness of breath, and near the summit they refuse to move more than 20 feet or so without stopping to get their breath. As a rule, however, they stand the strain remarkably well, and have, on several occasions when grass was taken to the summit, eaten at the altitude of 19,200 feet with the greatest apparent relish. Some of the mules belonging to the observatory have made the trip to the summit more than fifty times.

The writer's first ascent was made on October 7 last, and was his first experience at a greater altitude than 9,000 feet. At the height of 13,400 feet, where it was necessary to walk about 300 feet, slightly up hill, to visit the instrument shelter, he was obliged to walk slowly, and even then got quite out of breath; but no considerable effects of the altitude were noticed until after the arrival at the "M. B." hut, at the altitude of 15,700 feet. Here the slight exertion of dismounting from the mule and walking into the hut brought on a violent headache, and the feeling of exhaustion was so great that any exercise, even of the most trifling character, seemed impossible. The writer was obliged to sit down at once, and could scarcely exert himself sufficiently to unpack the lunch basket, in order to take out the supplies for supper. A feeling of nausea, usually the first, as it is also the most common, symptom of mountain sickness, came on very soon, and the mere thought of eating was distasteful. However, after some delay, and by the use of considerable will power, a cup of hot milk and two soft-boiled eggs were disposed of, but it was found impossible to eat anything more. The night was passed in tolerable comfort, although the cold was so great that it was necessary to sleep with all one's clothing on, in a double set of winter underwear, ulster, and felt boots, and wrapped up in a sheepskin sleeping bag. Headache, a feeling of nausea, and quickened respiration were the only unpleasant symptoms noted during the night.

The following morning the headache was much lessened, but the feeling of exhaustion and nausea continued. The only food that could be taken was hot milk and an egg. The ride to the summit was accomplished without the appearance of any further unpleasant symptoms, but on the summit itself the feeling of complete exhaustion and of weakness was so great that for an hour and a half the slightest exertion was out of the question, and the writer was obliged to lie stretched out flat on the ground. There was some tendency to faintness during this time, and the headache and nausea continued. In a little less than two hours it was found possible, with great exertion, to change the sheets of the self-recording instruments, which were taken from and returned to the shelter by the guide, the writer remaining seated on the ground during the operation, as he found it impossible to lift the large-sized barograph, weighing perhaps 10 pounds, up into the shelter. When the time came for the descent, after two hours and a half spent on the summit, it was found necessary to have assistance in mounting the mule. At the hut, which was reached in two hours, the instrument shelter, placed about 300 feet from the hut, and about 75 feet higher up the mountain, had to be visited; and on this short walk two stops in order to take breath were necessary, and anything but a very slow walk was out of the question. The change to a lower altitude was, however, noticeable in a decrease in the feeling of exhaustion, but the headache and nausea continued for some two hours more, on the return ride to Arequipa. Although provided on this trip, with clinical thermometers and with a sphygmograph, the writer felt so miserably that he made very little use of these instruments. His temperature at 5:30 p. m., October 5, twelve hours before leaving Arequipa, was 98.4°, his respiration 24, and pulse 90; on the summit his temperature was 96.4°, respiration 34, and pulse 110; and twelve hours after arriving at Arequipa, at 10:30 a. m., October 8, the figures were 98.0°, 24, and 85 respectively. A rather unsatisfactory sphygmograph curve was obtained on the summit.

The second expedition to the Misti was made on November 9, and on this trip the writer suffered much less from mountain sickness than on the first. He was able, immediately after reaching the hut, at 15,700 feet, to walk to the instrument shelter, although two stops on the way were necessary, as before. An hour after taking this exercise the pulse was 128, the temperature 97.0°, and the respiration 30; the cor-

responding figures twelve hours before leaving Arequipa being 91, 98.6°, and 20. On this trip there was much less exhaustion than on the previous one; in fact, all the symptoms of mountain sickness were less marked. It was possible to walk in the hut without great exertion; there was much less feeling of nausea, and considerable appetite. The night was passed comfortably, except for the cold, which was very disagreeable. Supper and breakfast consisted of hot beef tea and milk biscuits. In the morning, immediately after waking, the temperature of the body was 96.2°, pulse 112, and respiration 30. On the summit the writer felt fairly well when lying down, but the exertion of walking even a few steps brought on a feeling of exhaustion and nausea, and increased his headache. Otherwise, he felt well, and even had considerable appetite, although it would probably have been impossible to eat much, even had there been any food at hand. Twenty minutes after reaching the summit the temperature was 97.2°, pulse 120, and respiration 32. In an hour and a half the respiration was 35, the pulse and temperature remaining the same. In two hours the temperature was 96.8°, the pulse 112, and respiration 34. Three fairly good sphygmograph curves were obtained on the summit, not without considerable difficulty, however. These curves, so far as the writer knows, are with one exception the only ones ever secured at so great an altitude as 19,200 feet. In counting the pulse on the summit it was quite unnecessary to place the finger on the wrist, as the heart beats could plainly be *heard*. The descent was begun two hours and a half after reaching the top. At the hut, after again walking to and from the shelter, the pulse was 130, but the respiration had decreased to 30. One hour after arrival at the observatory at Arequipa the temperature was 98.2°, pulse 116, and respiration 22, and twelve hours after arrival the pulse had fallen to 82, about the writer's normal at the observatory, and respiration to 22, the normal being 20.

While the ascent of the Misti is a very easy one, and is not for a moment to be compared with the difficult climb up such mountains as Aconcagua or Mont Blanc, the altitude is so great that a study of the physiological effects it produces is interesting. The writer fared very well, better, in fact, than most of those who have made the ascent. One of the former assistants at the observatory made the trip more than fifty times and never experienced any discomfort, and one gentleman was so well on the summit that he was able to smoke there. These, however, are the exceptions. Almost everyone has headache, nausea, and a feeling of intense weakness, and many are subject to faintness. The experience of the native guides, who are of mixed Spanish and Indian blood, is very striking in contrast to that of foreigners. These natives are usually able to walk all the way to the summit from the hut without any difficulty, and feel as well on the top as they do at the base.

SEISMIC AND OCEANIC NOISES.[1]

By SAMUEL W. KAIN and others.

(A) Mr. Samuel W. Kain, in his letter of April 27, 1898, says:

It gives me much pleasure to send you by this mail a copy of Professor Ganong's article. I am also sending you two short notes from lighthouse keepers at the mouth of the Bay of Fundy. Mr. McLaughlin is at the southern end of Grand Manan; Mr. Suthern is on Brier Island, on the Nova Scotian shore.

I wrote to these men in order to get some more information about this phenomenon. I have also personally questioned masters of fishing schooners, all of whom are familiar with these sounds, and among whom they are known by the somewhat vulgar but very expressive name of "sea farts." I am sending you these papers because I think these sounds very similar to those discussed in Europe about two years ago by Van den Broeck, Darwin, and others. A reference to them in the REVIEW may elicit more information than we now have.

(B) Walter B. McLaughlin, of Grand Manan, on remarkable sounds like gun reports, etc. (read March 1, 1898, before the Natural History Society of New Brunswick, and now quoted from the St. Croix Courier):

I beg to say that my attention was first called to these sounds in August, 1838. I was then a boy nine years old. I was with my brother and a fine young sailor, by the name of McCraw, of Lower Grandville, N. S. We were hooking mackerel, and I had just caught my first mackerel when "boom" went this heavy sound and away went our fine school of fish. McCraw said, "There she goes." I inquired the cause of these sounds so frequently made and the sailor's answer was: "We don't know, we hear them, but we can't explain them."

I have no doubt that many sounds heard by people on the main land are actually reports of Indians' guns in porpoise hunting, or the reports of our signal guns on those outer stations, but a practised man will not be deceived. I have noticed these sounds for fifty-nine years. I long since satisfied myself that these sounds are subterranean. I have heard them under the sea, under Gannet Rock, under the land (in South Lubec), and under Grand Manan in two different places; and, strange to say, we have had two splendid shots under this station lately, one on the evening of January 28 and the second on February 14, 1897. When they take place under Gannet Rock and under the land they have the heavy rattle of a 24-pounder cannon, exploded 40 feet from the buildings; but when they happen under the sea they have a dull harmless "boom," as such a gun would sound if fired 50 or more fathoms under the sea.

We used to hear those dull sounds frequently between the Wood Islands and Gannet Rock. They would often sound like the rush of a heavy ground swell into a subterranean cave. We always noticed them on fine calm days. I think this was because there was no wind or other noise to drown them. The first one of those sounds I heard under Gannet Rock was about fifty years ago, one clear, dark night, about 2 o'clock, a. m., in my watch. I was reading and was deeply interested, when bang went the shock of what seemed to be like a 24-pounder cannon. It brought down the soot from a heavy, boiler iron, extension pipe on the chimney top into an open fireplace. I, of course, went outside to investigate and found a clear, dark night with few clouds and light winds. It was, I think, in October.

My next experience of one of those sharp shocks was in the month of June, 1856, at South Lubec, West Quoddy Bay. I was at a Dr. William Small's, and was having a game at cards with the doctor about 2 o'clock in the morning, when bang went one of those subterranean guns, which nearly upset our lamp. I exclaimed, "An earthquake!" but the doctor said, "No; it's an airquake," an explanation I never heard before nor since till I read it in the bulletin of the Natural History Society.

My third experience of those shocks on solid ground was at Seal Cove about eight years ago, say at 11 o'clock in the evening, when the shock was exactly as the former ones, the night being quiet and dark with very light winds. Again on the 28th of January of this year (1897) at 9 o'clock in the evening we got such a shock under this lighthouse that we thought the tops of our chimneys had gone by the board. Our dogs took to barking and our cattle tried to break loose in the stable. I noted this shock in my journal and told my people that we would hear of an earthquake on the mainland, but when the mail came we found that the earthquake was two days ahead of our tremor. On the evening of February 14, at 9 p. m., we received another shock, but not so violent as that of January.

I have given you my experience of fifty-nine years, and I will now affirm that I strongly believe these sounds are of subterranean origin.

(C) E. W. Suthern, from a letter to Mr. Kain, dated April 15, 1898, at Westport Light, Brier Island, Digby County, N. S.:

I have noticed these sounds many times when I have been out on the Bay of Fundy on fine, calm days in the summer. I spend a good deal of time in this way, shooting porpoises and birds. The sounds heard in this place are like the distant firing of heavy guns. I have heard these sounds on all sides of my boat, and that is what has puzzled me. I have heard them between my boat and the shore when one-half mile off shore, and again I have heard them in the same direction, ten miles off. I have also heard them in a southwesterly direction, and there is no land within 300 miles southwest of here, and I know that the Indians are not shooting porpoises in that direction.

In my opinion these sounds are not the firing of guns; they are heard

[1] The Editor is indebted to the kindness of Samuel W. Kain, Librarian of the Natural History Society, St. John, N. B., for these valuable contributions to the study of certain remarkable sounds that have been observed in many parts of the world at sea and near the coasts. References to these noises have frequently been made in Nature and other European journals, as also in the MONTHLY WEATHER REVIEW during 1896 and 1897. They are known as "mist pouffers" off the coast of Holland and as "barisal guns" off the mouth of the Ganges. Mr. Kain's contributions establish the fact of their frequency in the Bay of Fundy.

only in calm, warm weather, and never in the nighttime or in the winter. I have asked the fishermen about them and they say that they hear these sounds on all sides of them.

(D) W. F. Ganong, of Smith College, Northampton, Mass., on remarkable sounds, like gun reports, heard upon the southern coast of New Brunswick (dated December 24, 1896, Bulletin XIV of the Natural History Society of New Brunswick):

Everybody who has been much upon our Charlotte County coast must remember that upon the still summer days, when the heat hovers upon the ocean, what seem to be gun or even cannon reports are heard at intervals coming from seaward. The residents always say, in answer to one's question: "Indians shooting porpoise off Grand Manan." This explanation I never believed; the sound of a gun report could not come so far, and, besides, the noise is of too deep and booming a character. I have often puzzled over the matter, and it is consequently with great pleasure that I find in Nature for October 31, 1895, a short article by Prof. G. H. Darwin, in which he calls attention to the occurrence of what is obviously the same phenomenon in the delta of the Ganges, upon the coast of Belgium, and in parts of Scotland, and in which he asks for experiences from other parts of the world. Two explanations are suggested by his correspondent, M. Van den Broeck, of Belgium, who called his attention to the phenomenon, one that the reports are of atmospheric origin, due to peculiar electrical discharges; the other that they are internal in the earth, due, perhaps, to shock of the internal liquid mass against the solid crust. The following number of Nature contains notes which suggest that the reports may accompany the formation of faults or may result from earthquakes too slight to be otherwise perceived, and later numbers of that journal contain numerous letters upon strange sounds heard in different parts of the world, with various explanations.

The discussion upon the subject by this society on December 3, 1895, has called out further information showing that others besides myself have noticed these or similar sounds in New Brunswick. The late Edward Jack, a keen observer of things in nature, wrote me under date December 13, 1895, "I have often noticed in Passamaquoddy Bay, when I was duck shooting in the early spring mornings, the noises of which you speak; they always seemed to come from the south side of the bay. They resembled more the resonance from the falling of some heavy body into the water than that of the firing of a gun, such as is produced by a cake of ice breaking away from a large sheet of it and toppling over into the sea. These noises were heard by me only in very calm spring mornings when there was no breath of air; * * * there was nothing subterranean in them." Capt. Charles Bishop, of the schooner *Susie Prescott*, has told Mr. S. W. Kain that he has heard these sounds 40 miles from land between Grand Manan, the Georges Banks, and Mount Desert Rock. They are reported also from the Kennebecasis. Mr. Keith A. Barber, of Torryburn Cove, wrote December 26, 1895, to this society: "I have heard sounds similar to those on the Kennebecasis in the warm days of summer. They seemed to come from a southeasterly direction." Mr. Arthur Lordly, a member of this society who resides in the summer at Riverside, has also told Mr. Kain that he has heard similar sounds, on clear warm days, on the Kennebecasis, from a southwest direction. No other reports of this occurrence in New Brunswick have reached me. The Scientific American (June 27, 1896, p. 403) has called attention to them and requested that observations be communicated to its columns, but apparently so far without result.

The latest opinion as to the origin of sounds appears to favor an atmospheric origin, possibly connected with electrical disturbances. A very detailed circular, calling for exact observations, with series of questions and blank forms has been issued by M. Van den Broeck, of Brussels, who appears to have been the first to call scientific attention to them. It is very desirable, since the sounds occur here, that they should be scientifically observed and recorded; and it will be best to communicate the results to this society, through which they will reach those who can make the best use of them. To secure the best results the following form, altered somewhat from M. Van den Broeck's circular, should be followed:

Name of observer.
Date of observation.
Exact place of observation.
Exact time of each observation.
Direction of the sound.
Character of the sound (full description with comparisons).
Wind direction and velocity.
State of the sky.
State of the sea.
Mist conditions.
Barometer (state of the weather a few hours before and after).
Temperature.
Other remarks, including suggestions as to their origin, and reasons why they can not be gun reports.

(E) Although the above-described sounds have generally been attributed to some form of disturbance within the earth, the noise from which comes up through the ocean, and although they are, therefore, called *seismic* noises, yet it is by no means certain that they may not have a very different origin and it would be more proper to call them *oceanic* noises. The descriptions given of these oceanic noises show that sometimes they have precisely the same characteristics as the noises that may be heard in an aquarium when one stands alongside of a big glass tank and watches the motions of the drum fish. The salt water drum fish (*Pogonias chromis*) is common on the Atlantic Coast of the United States, and other varieties will doubtless be found in other parts of the world. A large drum fish will give out a sound that may be heard a long distance. As the sound is refracted into a nearly horizontal direction on its emergence from a level surface of water, it may seem to come from a great distance in the air when it really is near at hand in the water underneath or near to a fisherman's boat. If there are other fishes of great size that can give forth louder sounds, having different notes, we should not be surprised at the variety of descriptions of the various mysterious sounds. But at present these oceanic noises defy all attempts at rational explanation; we must wait until accurate observations have been collected.

As these sounds appear to be very frequent on fine, calm summer days in the Bay of Fundy, it seems practicable to start a special investigation of the subject in that neighborhood. The actual direction whence a sound comes that originates under water can best be studied by means of a pair of tubes whose lower ends are closed by metal or preferably glass plates. The upper end of the tube being open and in open air while the lower end is immersed several feet under water and pointed successively in different directions, we have only to ascertain the direction for which the sound that enters the tube is strongest in order to know the direction whence it comes. The use of this tube avoids the error incident to the refraction of the sounds as they emerge from the surface of the water.—ED.

(F) Through the kindness of Prof. Alexander Agassiz, the Editor has been favored with the following note, under date of May 23, 1898, from Dr. S. Garman, Icthyologist to the Museum of Comparative Zoology at Cambridge, Mass.:

The list of noisy fishes is an extensive one; it runs through the *Sciænoids*, *Cottoids*, *Batrachoids*, *Cyprinoids*, *Siluroids*, *Gymnodonts*, and others. Most of them are small and their voices are not loud. *Myliobatis*, *Ætobatis*, and *Rhinoptera*, among the rays, are said to make a noise by grinding their teeth when caught; it may be they also do it when feeding. But the fishes that will best answer the queries of your correspondent are the large *Sciænidæ*, many of them probably more or less noisy. In their cases the dates of hearing the sounds should be noted. The large "drum," *Pogonias*, attains a length of more than 4 feet. The following, from page 118 of Holbrook's Ichthyology of South Carolina, 1860, relates to it: "At this time [April] the drum enters the different bays and inlets of salt water along the shores of South Carolina to deposit its spawn, and then begins its drumming noise; this season passed, the sound is no longer heard, and the fish is then rarely taken.

"The way in which the singular sound called drumming is produced has not hitherto been satisfactorily explained. Cuvier observes that it may depend upon the air bladder, though he says it has no communication with the external atmosphere. DeKay supposes it 'to be occasioned by the strong compression of the expanded pharyngeal teeth upon each other.'

"Frequent examinations of the structure and arrangement of the air bladder, as well as observations on the living animal just taken from the water, when the sound is at intervals still continued, satisfied me that it is made in the air bladder itself; that the vibrations are produced by the air being forced by strong muscular contractions through a narrow opening, from one large cavity, that of the air bladder, to another, that of the cavity of the lateral horn; and if the hands be placed on the side of the animal, vibrations will be felt in the lateral horn corresponding with each sound.

"Ichthyologists differ also as to the character of the sound. Schœpff speaks of it as 'a hollow, rumbling sound under water;' Dr. Mitchill, as a 'drumming noise;' Dr. DeKay says when the fish is 'freshly taken from the water it sounds as if two stones were rubbed together.' It resembles most the tap of a drum, and is so loud that when multi-

tudes of them are collected together it can be heard in still weather 'several hundred yards from the water.'"

The drum of which Holbrook writes is *Pogonias cromis* Linne, 1766.

(G) Note by Prof. A. E. Verrill, of Yale University, New Haven, Conn. (dated May 31, 1898):

There are numerous fishes, both marine and fresh water, that are capable of making sounds of considerable volume under water. Such fish noises might very well account for many instances of the noises referred to. The drum fishes, the "grunts," are good "examples of sound-producing fishes."

(H) To the preceding note by Dr. Garman the editor would add the suggestion that the intensity and character of the sound, as heard in the air, will depend somewhat upon the relation between the depth of the fish in the water and the pitch of the note uttered by it.

Just as the vibrating column of air in an organ reed pipe produces the greatest effect when it is in perfect unison with the vibrating tongue at the base, so it is with the column of water above the drum fish. An open organ pipe that is controlled by a spring or reed that vibrates to the lowest C of the bass clef, namely, thirty-two times per second, must have a length of 16 feet. The same pipe, if filled with fresh water, may be longer in the ratio 4708/1093, viz, the ratio between the velocity of sound in air and water. This gives a depth of about 70 feet at which the drum fish that strikes the bass C could produce the maximum noise as heard by the observer. If, now, the bottom of the water is 70 feet below the fish then he is at a nodal point, and the whole column vibrates in sympathy with him.—ED.

(I) Prof. William F. Ganong writes from Northampton, Mass., as follows, May 31, 1898:

I can not in the least accept your suggestion about the drum fish. It is true I have never heard this animal perform, but the sounds come from too far off and are too great to be made by a fish. On hills a quarter of a mile from the sea I have heard them, and the sound filled the air. Your mode of investigating them by the tubes would be difficult in practice, since the sounds come so rarely; days will pass without our hearing them, and even on favorable days they occur only once in a while, perhaps once in a day, but at the best they occur several hours apart as a rule; in fact, they may be described as rare and irregular. Hence, one would have to be on constant guard at the tube for hours and even days together. Mr. McLaughlin, of Document B, is a man for whose powers of observation and reliability I have the greatest respect, and his letter is, therefore, an important contribution to this subject.

(J) Instead of accepting any hypothetical explanation as satisfactory, it is best, at the present stage of the investigation, to keep one's mind free from prejudice in any special direction. It seems quite possible that the noises proceeding from the ocean may have very different characters and origins; some are undoubtedly due to the drum fish; others are made by the breakers dashing on rocky cliffs, whence heavy thuds spread for several miles through the air and many miles farther through the ocean; others are due to the cracking of rocks in ledges near the surface, such as those on which lighthouses are built; others, finally, are occasionally due to genuine earthquakes occurring at the bottom of the neighboring ocean. It is highly probable that a careful collation of observations from many stations in any given locality, such as the Bay of Fundy, will throw a clear light upon the locality whence the noises emanate.

In this connection it is worth calling to mind that there are eight or ten well-defined regions on the North American Continent within each of which there is a so-called center of seismic disturbance. There is no reason why similar centers should not exist under the ocean; in fact, the great solitary waves that have been frequently reported by vessels between New York and Newfoundland, and which have generally been plausibly explained as due to a combination of several ordinary waves, may sometimes be due to suboceanic earthquakes, just as similar great waves are known to have been produced by earthquakes in the Pacific.—ED.

METEOROLOGICAL WORK IN ALASKA.[1]

By A. J. HENRY, Chief of Division.

The meteorological work in Alaska and contiguous territory prior to the establishment of a weather service by the United States was admirably summarized in 1879 by Dr. William H. Dall, in his contributions to the Pacific Coast Pilot, published by the United States Coast and Geodetic Survey. The following remarks relate more especially to the work of recent years.

In the summer of 1872 the Federal Government sent a special agent to the Pribilof Islands for the purpose of studying the life and habits of the fur seal, concerning which little was then known.

As a promising field of collateral investigation the Signal Service, under the direction of Gen. A. J. Myer, began a series of meteorological observations on the island of St. Paul in August of the same year. The instructions given to the first observer detailed for duty in Alaska, Mr. Charles Pattison Fish, were very comprehensive. In addition to his daily routine duties, which included the making of six meteorological and certain special tidal observations, he was to keep accurate memoranda on a variety of subjects, some of which had only a remote connection with meteorology.

Mr. Fish remained on the island until the summer of 1876, when he was relieved by Mr. Edward J. Gill. The latter perished on October 22 of the same year in an attempt to reach his quarters during a violent storm. Shortly after the death of Mr. Gill observations were resumed by an employee of the Alaska Commercial Company and continued with some interruptions until June 30, 1883, when they were finally discontinued by the Signal Service. It is understood, however, that meteorological observations have since been made by the company above named, in fact, a more or less complete register, extending from September, 1892, to June, 1895, made by that company, was sent to the Weather Bureau in 1895.

After the occupation of St. Paul, in 1872, meteorological stations of the first order were next established at Fort St. Michael in 1874, Unalaska in 1878, Atka in 1879, and Sitka in 1881.

Interest in meteorological work in the arctic regions was greatly stimulated in all quarters by the discussions of the International Geographical and Meteorological Congresses of 1879–81, and especially by the action of the congress in formulating plans for the establishment of an international chain of magnetic and meteorological stations at high latitudes. The part taken by the Signal Service in the general scheme of international work is a matter of history, the details of which have been fully published elsewhere. As supplementary to the main work at high latitudes active operations were begun with a view of increasing the number of observing stations in Alaska. The formal order on the subject, approved March 16, 1881, follows:

INSTRUCTIONS No. 31.

There will be establishment in Alaska, under the supervision of the Signal Service observers on duty there, substations and third-class stations, as follows:

[1] The importance of extending our daily weather map to the greatest possible extent, so as to include all the circumstances attending our storms and cold waves, was deeply impressed upon our attention during the progress of the work of the Signal Service in 1871, and the Chief Signal Officer, Gen. A. J. Myer, willingly accepted the idea of taking the most generous possible interpretation of our privileges and duties in this respect. The limit covered by our system of observing stations was first extended in June, 1871, by distributing forms to masters of vessels along the Atlantic Coast; in 1872 the first steps were taken toward securing data from Alaska; and in 1873 General Myer began the organization of the international system of simultaneous meteorological observations which soon covered the whole Northern Hemisphere. It is to be hoped that the publication of the International Bulletin has done much to stimulate the study of the atmosphere as a whole. Climatology may deal with very restricted localities, but meteorology must consider the whole atmosphere.—ED.

From Sitka, substations at Yakutat Bay, Portage Bay, and Cordova Bay; third-class stations at four (4) points to be selected by the observer at Sitka.

From Unalaska, substations at Atka, Kenai, Port Etches (Nutcheek), and Kuskokvim; third-class stations at four (4) points to be selected by the observer at Unalaska.

From St. Michael, substations at Fort Yukon and Nulato; third-class stations at three (3) points to be selected by the observer at St. Michael.

Substations will be furnished with one (1) of each of the following named instruments: aneroid barometer, exposed, maximum and minimum thermometers, anemometer, and rain gauge, and will take the 3 p. m. and 11 p. m., Washington mean time observations.

Third-class stations will be furnished with one (1) of each of the following named instruments: maximum and minimum thermometers and rain gauge, and will take one (1) observation daily at about sunset.

The reports from the above mentioned sub and third-class stations will be collected by the Signal Service observers at the central points named above, and will be, after examination, in order to correct apparent errors in methods of recording, forwarded by them to this office.

(Signed) W. B. HAZEN,
Brigadier and Brevet Major-General,
Chief Signal Officer, U. S. A.

In establishing new stations in a country so sparsely settled as Alaska, great difficulty must necessarily be experienced in securing suitable observers. In the present case but two classes could be drawn upon, viz, missionaries and post traders. The former, while mentally well equipped for the light duties required, spent much time in traveling throughout their fields of labor and were consequently unable to make observations continuously. The post traders, while generally able and willing to make simple observations of temperature and precipitation during the closed season, were not willing to continue throughout the open season for the small compensation allowed.

As a result of the efforts put forth in 1881–1882 about 25 stations were established, the majority of which, however, were on or near the coast. The meteorological service thus created was maintained until the spring of 1886. At this time its further existence was greatly jeopardized by the withdrawal of the active support of the Northwest Trading Company. The latter, having sold or abandoned the majority of its posts, was not in a position to extend the material aid it had formerly given. This fact, and possibly the increasing need elsewhere of the services of the regular observers stationed in Alaska, as well as a diminution in the appropriations, led to the abandonment of all stations in that Territory, except Sitka, in the early summer of 1886. Sitka was abandoned a little more than a year later, viz, in September, 1887, thus terminating the work of the Signal Service in Alaska.

In recent years quite a number of persons, either resident in Alaska or moving thither, have been supplied with meteorological instruments by the Weather Bureau. The returns from these instruments have been meager; in some instances no observations whatever appear to have been made.

The accompanying table shows the stations in Alaska and contiguous territory from which meteorological observations have been received up to the end of 1897, the latitude, longitude, and elevation of the stations, where known, and the period during which observations were made. The notes in the column "Remarks" indicate, as fully as possible in the limited space available, the nature of the observations made at each station.

The observations at second order stations include pressure, temperature, wind, weather, cloudiness, precipitation, relative humidity, and the usual phenomena recorded by stations of that class. The third order stations were divided into two groups or sections; at stations of the first group two observations were made daily, namely, of pressure, temperature, clouds (amount only), state of weather, precipitation, and a single reading of the anemometer dial giving the total daily wind travel; at stations of the second group a single observation of the state of the weather, the daily extremes of temperature, and the amount of precipitation, if any, was made.

For the sake of completeness a list of Asiatic stations taken from the Pacific Coast Pilot, Alaska, Appendix Meteorology, compiled by Dr. W. H. Dall, Assistant U. S. Coast Survey, and a similar list of stations in the Northwest Territory, compiled from the publications of the Meteorological Service of the Dominion of Canada, Prof R. F. Stupart, director, have been added.

THE ALASKAN SECTION OF THE CLIMATE AND CROP SERVICE.

[Extracts from Official Orders.]

In order to respond to the recent demand for meteorological information, the present Chief of the Weather Bureau has lately established an Alaskan section of the Climate and Crop Service. Mr. Hector D. Ball has been appointed section director, in cooperation with Professor Georgeson, who will establish an agricultural experiment station near Sitka. Under instructions of April 7, Mr. Ball proceeded to Sitka, where he arrived on May 6. He is required to establish "an efficient climatic service in the Territory of Alaska and also as far as practicable establish and maintain a regular station of the Weather Bureau at Sitka or some other desirable point." This latter station will need a building that will be erected by Professor Georgeson in connection with his agricultural experiment station. This central station will be provided with self-registers for wind velocity and sunshine, a barograph and thermograph, and all the other apparatus of a first-class station. Apparatus for the establishment of ten subsidiary stations during the present season is also furnished. These will be voluntary stations, reporting directly to Mr. Ball. It is hoped that those to whom instruments have been issued from time to time in previous years will also revive their interests and report to him. The accompanying lists of those that have either promised or actually maintained voluntary stations is of importance to those interested in the climate of Alaska.

For the present, in view of the great amount of work necessary in the way of visiting and instructing voluntary observers, the station at Sitka will, by cooperation with Professor Georgeson, be only able to keep the record of observations at 8 a. m. and 8 p. m., which will serve as a base for the correction of the readings from the barograph and thermograph.

The following list has been furnished to Mr. Ball for his information in hopes that all the voluntary observing stations in Alaska and the Northwest Territory that have been furnished with instruments by the Weather Bureau may be brought into successful activity. As several of these have not been heard from for some time it is requested that any one who knows of the location of these instruments or observers will report the fact to the Chief of the Weather Bureau at Washington, D. C. The numbers of the instruments are given when practicable in order to assist in their identification.

VOLUNTARY STATIONS IN ALASKA AND NORTHWEST TERRITORIES.

Anvik.—Rev. John W. Chapman, observer, not heard from for several years.

Birch Creek.—H. H. Pitts, observer; has exposed No. 1044; maximum No. 2422; minimum No. 2021; barometer No. 203; and rain gauge No. 2327, issued December, 1894; sent care of Alaska Commercial Company, No. 310 Sanson street, San Francisco, Cal.; instruments were seized by customs authorities at Forty Mile, N. W. T.; Canadian authorities requested to liberate same April 13, 1896; no reports.

Cape Prince of Wales.—.......................... Exposed Nos. 83 and 316; maximum No. 1350; minimum No.

1267; aneroid barometer No. 191; and rain gauge No. 300; issued June, 1890; observer murdered by the natives August 19, 1893, and instruments supposed to have been destroyed.

Coal Harbor.—H. S. Tibbey, observer; reports now being received; has anemometer No. 150; exposed No. 226; maximum No. 1369; minimum No. 1265; rain gauge No. 297; and barometer No. 230; barometer was returned to Sacramento, in 1894, for repair.

Circle City.—Observer to be selected by Seattle-Yukon Transportation Company, Seattle, Wash., through whom instruments, etc., are to be located at Circle City, Dawson City, and Munook; instruments sent to observer, Seattle, Wash., to be turned over to the Transportation Company; instruments issued March, 1898.

Dawson City.—See note for Circle City.

Holy Cross Mission.—F. Monroe, observer; station established through Rev. Pascal Tosi; has exposed No. 3465; maximum No. 3501; minimum No. 3165; barometer and rain gauge, numbers not given; last report received July, 1897.

Killisnoo.—Jos. Zuboff, observer; has exposed Nos. 611 and 1463; maximum No. 2398; minimum No. 3252; aneroid barometer No. 162; and anemometer No. 420; established June, 1889; reports being received; last one for February, 1898.

Juneau City.—Gus. B. Leach, observer, "Alaska Mining Record;" has exposed Nos. 991 and 1464; maximum No. 3969; minimum No. 3638; and rain gauge No. 2291; were issued October, 1894; last report received for February, 1897.

Kadiak Island.—Hon. Alphonso C. Edwards, observer; has maximum No. 4574; minimum 3647; and barometer No. 341; instruments issued from San Francisco, Cal., in 1896; last report received for August, 1896.

Kowak River.—Robert Samms (a Friend missionary), observer; has maximum No. 4026; minimum No. 4498; instruments issued from San Francisco, Cal., in June, 1897; no reports as yet.

Munook.—See note for Circle City.

Ogilvie, N. W. T.—Jos. Ladue, observer; has exposed No. 1917; maximum No. 3990; minimum No. 1571; and rain gauge No. 2337; see note relative to seizure of instruments for Birch Creek; instruments for this station and for Selkirk seized at the same time; same action; no reports.

Point Hope.—Rev. E. H. Edson, observer, care S. Foster & Co., No. 28 California street, San Francisco, Cal.; has maximum No. 3862; minimum No. 3547; and rain gauge No. 2240; issued May 24, 1894; last report received for July, 1896.

Port Clarence.—J. C. Widstead, observer; has maximum No. 4226; minimum No. 2132; barometer No. 328; and rain gauge No. 2154; issued May 24, 1895; last report received September, 1897.

St. Joseph Mission.—J. M. Trece, observer (established through Rev. Pascal Tosi); has exposed No. 3679; last report received for July, 1896.

St. Lawrence Island.—V. C. Gambell, observer; has exposed Nos. 1830 and 2204; maximum No. 3850; minimum No. 3507; and rain gauge No. 1671; issued from San Francisco, Cal., in May, 1894; last report received for February, 1897.

St. Peters Mission (Nulato).—F. Monroe, observer (established through Rev. Pascal Tosi); no record of instruments forming equipment, though presumed to be from among those sent out with Father Tosi; last report received for April, 1896.

Selkirk, N. W. T.—A. Harper, observer; has exposed No. 1879; maximum No. 4016; minimum No. 1373; barometer No. 448; and rain gauge No. 2318; these instruments were among those seized at Forty Mile, as stated in note under Birch Creek.

Two trading posts on the Yukon; Mr. Weare and Captain Healy, President and Manager, respectively, of the North American Transportation and Trading Company, St. Michael, Alaska; the instruments issued are maximum Nos. 4157 and 4159; minimum Nos. 2054 and 2057; rain gauges Nos. 2285 and 2297; these were sent out in June, 1895; no reports received.

Index of records of meteorological observations made in Alaska from the earliest dates to January 1, 1898.

Stations.	Latitude.		Longitude.		Elevation above sea level.	Record. Length.		Record. From—	Record. To (inclusive)—	Remarks.
	°	′	°	′	*Feet.*	*Yrs.*	*Mos.*			
Point Barrow (Ooglaamie)	71	17	156	40	17	2	0	Sept., 1852	Aug., 1854	Temperature (maximum, minimum, mean).
						1	9	Oct., 1881	Aug., 1883	2d order.
								Aug., 1889	July, 1893	3d order.
Omilak	65	00	162	57		1	0	Jan., 1884	April, 1885	3d order, one observation daily.
Tuklukyet (Nuklukayet, Tanana)	65	10	152	45		3	3	Aug., 1882	May, 1886	3d order, two observations daily.
Belle Isle (Tchatowklin)	65	30	142	38		2	2	Oct., 1882	May, 1886	Do.
Fort Reliance	64	10	139	25		1	6	Sept., 1880	May, 1881	Temperature, wind, weather.
								Sept., 1882	May, 1886	3d order, one observation daily.
Fort St. Michael, on St. Michael Island	63	28	161	48	30	1	6	Aug., 1842	July, 1855	Temperature observations at 8 a. m., 3 and 9 p. m.
						2	0	Oct., 1865	June, 1874	Pressure, temperature, rain, snow, wind, weather.
						12	0	June, 1874	June, 1886	2d order, full reports.
Mission	62	55	161	05		2	3	Aug., 1883	May, 1886	3d order, one observation daily.
Anvik	62	37	160	08		2	3	Sept., 1882	May, 1885	Do.
								Sept., 1887	Mar., 1891	Fragmentary records.
Redoubt Kolmakof (Koskokvim)	61	50	157	58		0	2	Dec., 1843	Feb., 1844	Temperature and weather.
						2	9	July, 1882	May, 1886	3d order, two observations daily.
Fort Kenai (Kenai)	60	32	151	19	80	0	2	July, 1870	Aug., 1870	Temperature, rain, snow, clouds, and wind.
						3	5	Jan., 1883	May, 1886	3d order, two observations daily, aneroid barometer.
Port Etches	60	18	146	30		1	4	May, 1883	Aug., 1884	Do.
Fort Alexander	58	57	158	18	38	3	0	Aug., 1881	June, 1885	3d order, two observations daily.
						0	11	July, 1885	June, 1886	2d order, mercurial barometer.
Chilkat (Pyramid Harbor)	59	20	135	30		6	2	Sept., 1881	Dec., 1887	3d order, two observations daily, aneroid barometer.
Juneau (Harrisburg)	58	19	134	28		2	2	June, 1881	Oct., 1884	3d order, two observations for a portion of the time.
						3	8	July, 1888	Feb., 1897	Temperature, precipitation, relative humidity, clouds, wind, and weather.
St. Paul Island	57	10	170	01	40	5	1	Aug., 1839	Aug., 1844	Temperature.
						1	9	Nov., 1869	Dec., 1871	Temperature, rain, snow, and wind.
Do	57	10	170	01	57	8	8	Aug., 1872	May, 1883	2d order, full observations.
								Sept., 1892	June, 1895	Pressure, temperature, wind and weather, ocean swell (Alaska Commercial Company).
Ugashik	57	38	157	45		2	3	Aug., 1883	Jan., 1886	3d order, one observation daily.
Killisnoo (Hoochnahoo)	57	28	134	29		13	6	May, 1881	Mar., 1898	1881-88, 3d order, two observations daily, pressure, temperature, precipitation, wind, clouds, weather.
Sitka	57	03	135	19	63	45	2	Jan., 1828	Dec., 1876	Pressure, temperature, rain, snow, clouds, vapor pressure, wind.
						6	5	April, 1881	Sept., 1887	2d order, full observations.
Bering Island	55	12	165	55*	20	5	0	May, 1882	May, 1886	Do.
Marshovo (Marzovia)	55	03	163	10		1	5	Nov., 1881	May, 1883	3d order, one observation daily.
Unalaska (Iliuliuk Village)	53	53	166	32	13	8	10	Jan., 1825	May, 1834	Pressure, temperature, rain, snow, relative humidity, wind, etc.
						2	3	Nov., 1866	Sept., 1874	
						6	2	Aug., 1878	May, 1886	2d order, full observations, except from June, 1881, to March, 1882, when 3d order of two observations.

Index of records of meteorological observations made in Alaska—Continued.

Stations.	Latitude.		Longitude.		Elevation above sea level.	Record. Length.		Record. From—	Record. To (inclusive)—	Remarks.
	°	′	°	′	*Feet.*	*Yrs.*	*Mos.*			
Atka (island)	52	15	174	15	....	0	4	May, 1879	Aug., 1879	2d order, no barometer.
						3	7	Oct., 1881	May, 1885	3d order, two observations daily, aneroid barometer.
						0	4	May, 1886	Aug., 1886	3d order, two observations daily.
Kyska (island)	51	59	177	37*	....	1	0	May, 1885	May, 1886	3d order, two observations daily, aneroid barometer.
Nulato	64	41	157	58	100	0	5	Feb., 1843	June, 1843	Temperature, snowfall, weather.
						6	0	Dec., 1866	May, 1867	Pressure, temperature, wind.
						0	4	Jan., 1896	April, 1896	Pressure, temperature, clouds, wind, weather.
Hoonyah	59	45	140	00	....	0	1	Mar., 1882	Mar., 1882	Fragmentary record.
St. George Island	56	37	169	37	....	....		....	....	
Fort Wrangell	56	30	132	28	25 to 35	4	8	May, 1868	May, 1877	Pressure, temperature, rain, snow, clouds, wind, weather.
						0	10	Sept., 1881	Aug., 1882	Temperature.
Cordova Bay (Jackson, Howkan)	54	45	133	00	....	....		Aug., 1882	Dec., 1882	Fragmentary record.
Chernofski Harbor	53	25	167	14	....	....		Oct., 1881	Feb., 1882	Do.
Attu (island)	52	58	173	00	....	....		July, 1880	May, 1881	Do.
Choris Peninsula	66	13	161	46	....	0	10	Aug., 1849	May, 1850	Mean temperature only.
Ikogmut	61	47	161	14	50 to 100	0	3	Sept., 1843	Dec., 1854	Temperature, rainy and snowy days, wind, weather.
Port Moller on Moller Island	56	01	160	47	12	0	5	Dec., 1877	April, 1878	Pressure, temperature, wind, rain, and snow.
St. Paul (Kadiak Island)	57	47	152	20	....	2	8	Jan., 1869	Dec., 1873	Pressure, temperature, rain, snow, wind, weather.
						9	0	July, 1881	Aug., 1890	Temperature, precipitation.
						....		Nov., 1895	Aug., 1896	Pressure, temperature, precipitation, clouds, wind, and weather.
Fort Tongass	54	46	130	30	20	2	7	June, 1868	Dec., 1870	Pressure, temperature, rain, snow, wind, weather.
Unalaklik	63	54	160	45	20	0	3	Nov., 1866	Jan., 1867	Temperature.
Fort Yukon	66	34	145	18	412	0	6	Jan., 1861	July, 1861	Temperature, precipitation.
						0	1	Aug., 1869	Aug., 1869	Pressure, temperature.
						1	0	Jan., 1870	Dec., 1870	Temperature.
Yukon Delta	....		....		....	0	5	Jan., 1895	May, 1895	Do.
Camp Davidson†	....		....		....	1	10	Sept., 1889	June, 1891	Temperature (mean, maximum, minimum), clouds, precipitation, pressure, wind, etc.
Camp Colonna†	....		....		....	0	9	Oct., 1889	June, 1890	Temperature (maximum, minimum, mean), precipitation, pressure, wind, etc.
Port Clarence	65	17	166	20	....	2	0	July, 1850	June, 1852	Temperature.
						2	0	July, 1895	Dec., 1897	Pressure, temperature, precipitation, clouds, wind, weather.
Cape Prince of Wales	....		....		....	0	9	Oct., 1890	June, 1891	Temperature, wind, weather.
St. Peters Mission	64	30	156	00	....	1	1	Oct., 1894	April, 1896	Pressure, temperature, precipitation, clouds, weather.
St. Lawrence Island	63	34	171	45	....	1	11	Oct., 1894	Aug., 1896	Temperature, precipitation, clouds, wind, weather.
Point Hope	68	25	166	38	....	2	2	Aug., 1894	July, 1896	Pressure, temperature, precipitation, clouds, wind, weather.
Metlakahtla (British Columbia)	54	11	130	17	....	2	9	Nov., 1891	July, 1894	Do.
Holy Cross Mission	63	28	162	04	....	2	11	Jan., 1894	July, 1897	Do.
Unga Island (Coal Harbor)	55	20	160	38	30	10	8	July, 1886	Dec., 1897	Temperature, precipitation, clouds, wind, weather.
St. Josephs Mission	62	15	163	45	....	2	1	Jan., 1894	July, 1896	Temperature, clouds, wind, weather.
Kotzebue Sound	66	58	165	07	15	0	3	July, 1827	Sept., 1827	
						1	0	Jan., 1857	Dec., 1857	Temperature.

STATIONS IN CONTIGUOUS BRITISH TERRITORY.

Stations.	Latitude.		Longitude.		Elevation above sea level.	Record. Length.		Record. From—	Record. To (inclusive)—	Remarks.
Fort Constantine	....		....		....	6	8	Nov., 1895	June, 1896	Temperature (mean, maximum, minimum).
Good Hope	....		....		....	0	9	Oct., 1885	Jan., 1887	Temperature. .
Fort Chippewayan	58	43	111	19	....	....		1883	1887	Temperature, precipitation.
Fort Dunnegan	55	56	119	02	....	....		1880	1884	Temperature (mean, maximum, minimum), precipitation (rain and snow).
Fort Rae	62	39	115	44	....	1	0	1875	1875	Temperature (mean, maximum, minimum), cloudiness, precipitation (rain and snow), wind.
						....		Sept., 1882	Aug., 1883	
Lesser Slave Lake	55	20	115	30	....	....		1884	1885	Temperature (mean, maximum, minimum), precipitation (rain and snow).
Fort Simpson	61	52	121	25	....	0	7	May, 1875	Nov., 1875	Temperature (mean, maximum, minimum), wind, cloudiness, precipitation.
Queen Charlotte Island (at Massett)	52	20	131	11	....	0	2	Jan., 1863	Feb., 1863	Temperature, precipitation, wind, clouds.
Fort Franklin (Hudson Bay)	65	11	123	12	....	1	9	Sept., 1825	May, 1827	Mean temperature only.

ASIATIC STATIONS (PACIFIC COAST PILOT).

Stations.	Latitude.		Longitude.		Elevation above sea level.	Record. Length.		Record. From—	Record. To (inclusive)—	Remarks.
Port Aian	56	27	138	11*	40 to 50	5	4	June, 1843	Dec., 1850	Pressure, temperature, wind, and weather.
Ala River	54	33	135	58*	10 to 15	0	3	April, 1831	June, 1831	Do.
Anadyr River	64	55	177	19*	20	0	9	Oct., 1866	June, 1867	Do.
Duë Lighthouse	50	50	147	07*	300 to 350	2	0	Jan., 1866	Dec., 1868	
						1	6	Jan., 1874	Jan., 1875	Pressure, temperature, wind, and weather.
Hakodadi	41	47	140	45*	30 to 150	4	4	Jan., 1859	May, 1863	Do.
Kusunai	47	59	142	20*	....	1	0	July, 1867	July, 1868	Do.
Muravieff	46	48	142	30*	....	1	0	July, 1868	July, 1869	Temperature, wind, weather.
Nikolaieffsk	53	08	140	43*	54 to 102	6	9	Jan., 1866	Dec., 1873	Pressure, temperature, wind, weather.
Okkotsk	59	20	142	40*	12	7	8	May, 1843	Dec., 1850	Do.
Petropavlovsk	53	01	158	39*	37 to 50	1	0	Jan., 1828	Dec., 1828	Do.
						3	11	Jan., 1846	Dec., 1850	
						....		July, 1882	Aug., 1886	3d order, two observations daily, aneroid barometer.
Port Providence (Plover Bay)	64	30	173	06	....	0	10	Oct., 1848	Aug., 1849	Temperature.
Udsk	54	29	134	37*	....	0	5	Nov., 1829	Mar., 1830	Temperature, pressure, wind, weather.

*East. †Observations by United States Coast Survey parties.

THE INTERNATIONAL AERONAUTICAL CONFERENCE.

By A. LAWRENCE ROTCH (dated May 31, 1898).

The second meeting of the International Aeronautical Committee (which was appointed by the Paris Meteorological Conference of 1896) was held at Strassburg, Germany, March 31 to April 4, inclusive. Besides the President, Professor Hergesell of Strassburg, and the Secretary, M. de Fonvielle of Paris, there were present the following members of the committee: Messrs. Cailletet and Besançon of Paris, Assmann and Berson of Berlin, Erk of Munich, Rykatcheff and Kowanko of St. Petersburg, and Rotch of Boston, U. S. A. Regrets were sent to Messrs. Hermite and Violle, whom illness detained, and thanks were tendered to those governments and friends of science who proposed to search for André, a member of the committee. A number of physicists, meteorologists, and aeronauts were present as guests. The welcome of the German Government was extended by Von Schraut, Minister of Finance for Alsace-Loraine, who summarized the results achieved in exploring the atmosphere, and predicted a brilliant future. Professor Windelband, Rector of the University of Strassburg, emphasized the importance of these researches for the progress of humanity as well as for science. M. de Fonvielle replied for the committee.

The discussion of the provisional programme was then begun, with the questions relating to the *ballons sondes*. It was agreed that the introduction of a mechanical ballast discharger was necessary, and that all precautions should be taken to prevent derangement of the instruments; the stoppage of the clockwork was attributed to the contraction of the plates carrying the pivots, from the effect of great cold. As regards the calculation of the ascensional force of balloons and the influence of the temperature of the gas it was resolved that—

For each unmanned ascent the weight of the aerostatic material and the ascensional force at the start should be measured, and during the whole voyage the true temperature of the gas should be recorded.

Since the study of the meteorological conditions of the air in a vertical line is important it was considered advisable, in certain cases, to limit the length of the voyage by emptying the balloon automatically.

The instrumental equipment of *ballons sondes* was first considered. M. Teisserenc de Bort presented a report on the determination of height by the barometer.

Drs. Assmann and Berson said that the usual methods gave considerable errors, and they recommended the calculation of the height by successive strata, applying a correction for the change of temperature of the lower stratum during the ascent. The Conference decided that—

All nations should adopt the same formula of reduction, whatever method might be chosen ultimately.

M. Teisserenc de Bort analyzed the errors of the aneroid with respect to the mercurial barometer, but in regard to the latter it was pointed out by Dr. Berson that the mercurial column only represents the atmospheric pressure at the moment when the balloon has no vertical velocity. It was resolved that—

Simultaneous observations should be executed at the different stations, and that the instruments should be controlled by taking them in manned balloons. Besides this, the instruments ought to be interchanged among the different stations in as short a time as possible.

The determination of the temperature of the air in *ballons sondes* was introduced by a report of M. Teisserenc de Bort. Dr. Hergesell remarked that the temperature of the air varied so rapidly that it was necessary to apply a correction-formula which he had developed in the Meteorologische Zeitschrift, December, 1897. M. Cailletet exhibited a thermometer of his invention, which had for its bulb a spiral silver tube soldered to a glass tube, both being filled with the liquid toluene. He stated that it acquired the surrounding temperature in fifteen seconds. M. Teisserenc de Bort exhibited a self-recording thermometer, having a thin blade of german silver fixed in a frame of Guillaume's invariable steel. This instrument takes the temperature of the air rapidly (9° F. in fifteen seconds) and it is not affected by shocks. The ventilation in a balloon is secured by a fan driven by a weight on a wire which falls 5,000 feet in an hour and a half. Drs. Hergesell and Assmann described their attempts to construct a sensitive metallic thermometer, which the latter thought might be ventilated by the agitation of the air through a jet of liquid carbonic acid, but M. Cailletet pointed out that at low temperatures the tension of carbonic acid is too slight to produce ventilation. Dr. Berson remarked that in his high ascent, the upper clouds, at an altitude of 24,000 to 29,000 feet, radiated upon the instruments in the same way as does the surface of the earth at a moderate height. As a result of the discussion it was resolved—

(1) The rapidity of the thermometric variation is so great in *ballons sondes* that to record it thermometers must be employed which have much less thermal inertia than those hitherto employed, and (2) an efficient ventilation of the thermometers is indispensable.

The testing of thermometers at temperatures below those to which they would be exposed in *ballons sondes* was advised, and Dr. Erk described the apparatus of Dr. Linde, of Munich, for the production of a considerable quantity of liquid air. This means of refrigeration enables temperatures lower than 200° C. below zero to be obtained. The Conference recommended that—

Before the ascensions of *ballons sondes* the instruments be verified by varying the temperature and pressure under conditions similar to those to which they would be subjected in the atmosphere.

The equipment of manned balloons was next considered. Some remarks of Dr. Berson on the difficulty of reading a mercurial barometer, owing to the continual oscillations of the mercury, led to the following resolution:

During ascents, the mercurial barometer is the standard instrument for the comparison of aneroids, but for its observations to be trustworthy the acceleration must be zero; it is evident that this condition is fulfilled when the trajectory traced by the self-recording aneroid is horizontal.

In consequence of the statement that it was possible to verify the instruments by reproducing the curves traced by them, the Conference advised that—

There should be reproduced in the laboratory, with the aid of pneumatic and refrigerating apparatus, similar curves to those traced by the barometer and thermometer during balloon ascents.

Further discussion followed as to the methods of obtaining the height of the balloon. M. Cailletet described his apparatus for automatically photographing together, from time to time, the ground vertically below the balloon and the face of an aneroid barometer. From a map the route of the balloon as well as its true altitude are determined; the pressure is deduced from the barometer, and thus the law connecting atmospheric pressure with altitude can be studied. Photographs have been taken from a balloon 7,000 feet high which was moving 40 to 60 miles an hour. The accuracy of these measures was said to be within $\frac{1}{250}$ of the height. It is proposed to photograph a mercurial barometer in the same way. The Conference recommended the use of M. Cailletet's apparatus for both manned balloons and *ballons sondes*. The determination of the height by observations at the ground was brought to the attention of the Conference, and especially the "dromograph," invented by MM. Hermite and Besançon, for automatically registering the azimuths and angular altitudes observed, and the heliometer used by Dr. Kremser, of Berlin, for measuring the apparent diameter of the balloon.

Dr. Erk called attention to the fact that in the case of a large difference of temperature between the wet and dry bulbs of the aspiration psychrometer, the wet bulb always

had in its immediate neighborhood a warmer body, which is the interior cylinder surrounding it. The resulting error may be avoided by covering the interior cylinder with muslin, so that the dry bulb is protected by a cylinder having a temperature, t, and the wet bulb by a cylinder having a temperature, t'. The Conference thought it necessary that—

The instrumental equipment of manned balloons should be uniform, so far as possible. A recommendation has been made in regard to the barometers; concerning thermometers, the opinion is expressed that the aspiration psychrometer placed at the proper distance of at least 5 feet from the basket is the only instrument which should be employed in manned ascents. Simultaneous comparisons with the sling thermometer are recommended.

Drs. Berson and Hergesell urged the importance of simultaneous ascents in the different countries when a center of barometric depression existed over the European Continent. From a purely meteorological point of view the manned ascents have an importance which the *ballons sondes* do not, because the temperature of these high regions can have no influence on the meteorological elements near the surface of the earth. M. de Fonvielle, however, insisted upon the interest of deducing experimentally, from thermometric measures at a very great elevation, the temperature of the supra-atmospheric medium. He called attention to the possibility of choosing in this way between the kinetic theory of gases, which supposes a temperature of 273° C. below zero, and Fourier's theory which assumes that the temperature of space above the atmosphere is near that of the minima observed in the polar regions of the earth.

Future international balloon ascensions were next considered. It was deemed advisable that—

For each *ballon sonde* an instrument should be provided to serve as a basis of comparison with perfected instruments whose construction may change from one ascent to another on account of the improvements which may be attempted.

It was announced that in the next international ascent of *ballons sondes* Austria, Italy, and Belgium would participate, besides the countries which had already cooperated. This ascent was appointed for the beginning of June with certain stations of the international system to be chosen as starting points. The balloons should be as nearly as possible like those approved by the Conference, and the directors of the various meteorological systems were requested to institute observations on the days of the ascents according to the principles fixed by the President of the Committee. It was recommended that—

For the simultaneous study of the lower air strata, the observations from high stations be used, and especially those from kites and kite balloons.

After a presentation of various methods for effecting the safe landing and the recovery of *ballons sondes*, resolutions looking to these ends were adopted. Balloons may be protected against explosion caused by atmospheric electricity by covering their interior surface with a solution of potassium chlorate, which renders the fabric a conductor. For the measurement of atmospheric electricity the methods of Le Cadet, Börnstein, and André are recommended, especially the former.

Mr. Rotch read the report which he had been requested to prepare on the use of kites at Blue Hill Observatory, U. S. A., to obtain meteorological observations. He showed the advantages which kites possess over balloons up to heights exceeding 10,000 feet, whenever there is wind.

A letter from the Chief of the Weather Bureau explained the proposed use of kites to obtain data for a daily synoptic weather chart over the United States at the height of a mile or more. M. Teisserenc de Bort is equipping a kite station at Trappes, near Paris, after the model of Blue Hill, and General Rykatcheff stated that an anemograph of his invention was being raised with Hargrave kites at St. Petersburg. The Conference recommended the use of the kite in meteorology, and expressed the wish that all central observatories should make such observations, which are of prime importance for meteorology. On account of the favorable position of Mounts Cimone and Etna it is desirable that at the observatories on these mountains kites should be used in connection with the international balloon ascensions. The Conference expressed the desire that the chief observatories should be provided with the kite balloon of von Parseval and von Siegsfeld (see description hereafter) in order that there may be a certain number of permanent aerial stations, and following the idea of M. Tacchini it is hoped that kite balloons will be used in Italy on Mounts Viso and Etna, and also at the Military Park at Rome.

The following new members of the Committee were elected: M. Teisserenc de Bort and Prince Roland Bonaparte, of Paris, Professor Hildebrandsson, of Upsala, Professor Pernter and Lieutenant Hinterstoisser, of Vienna, Captain Moedebeck, of Strassburg, and Lieutenant von Siegsfeld, of Berlin. The next meeting was appointed for 1900, at Paris, during the Universal Exposition.

The Committee had the opportunity of witnessing two trials of the captive kite balloon, invented by Lieutenants von Parseval and von Siegsfeld, and constructed by Riedinger, of Augsburg, at a cost of $1,000, for Professor Hergesell and Captain Moedebeck. Although this form of balloon is used in the German army for reconnoitering, it was now employed for the first time to lift self-recording meteorological instruments. The cylindrical balloon is so attached to the cable that its upper end inclines toward the wind, which thus raises instead of depressing it, as in the case of captive spherical balloons. The wind enters an auxiliary envelope at the lower extremity and maintains the cylindrical form, notwithstanding any loss of gas. This wind bag also serves as a rudder, while lateral wings prevent rotation about the longer axis. The Strassburg balloon has a diameter of 14.7 feet, a length of 55.7 feet, and a volume of 7,770 cubic feet. The gas bag is varnished linen, and was filled with a mixture of hydrogen and coal gas. The weight of the balloon complete is 230 pounds, and the steel cable holding it weighs 2 pounds per 100 feet. The azimuth, altitude, and traction of the cable are recorded by a dynamometer invented by Riedinger. The meteorological instruments are contained in a basket (with open ends, through which the wind blows, but covered elsewhere with nickeled paper as a protection against insolation), suspended some 40 feet below the balloon. The self-recording instruments were a barometer and thermometer of Richard and a Robinson anemometer recording electrically. Although the kind of gas employed was hardly sufficient to lift the unnecessarily heavy basket and its contents, weighing 80 pounds, yet the trials made in rainy and windy weather were fairly successful, and a height of about 1,000 feet was reached. Without instruments the balloon had remained for several days above the city, and had withstood a gale.

The Committee also saw a hastily organized ascent of the *ballon sonde*, "Langenburg," which is a silk balloon of about 14,000 cubic feet capacity. When filled with coal gas it had an initial ascensional force of about 440 pounds in excess of its own weight and that of the instruments, contained in a cylindrical basket, which was open at top and bottom for ventilation, and was also covered with nickeled paper. They comprised a barometer and thermometer of Richard, and the metallic thermometer of Teisserenc de Bort, which all recorded on smoked paper. Owing to the premature launch of the balloon the ballast was left behind, and the escape of gas, owing to the too rapid ascent, prevented a great height from being reached. The balloon rose at about 6 p. m. with a velocity of nearly 23 feet per second, and disappeared in the strato-cumulus clouds in five minutes. It attained an alti-

tude exceeding 6 miles, and fell about 60 miles southeast of Strassburg, where it was found the next day. Unfortunately the shock caused by the breaking loose of the balloon stopped the clocks of the thermographs and prevented records of temperature from being obtained.

An official account of this Conference will be published in the French and German languages, together with the special reports prepared by the experts.

THE EIGHTH GENERAL MEETING OF THE GERMAN METEOROLOGICAL SOCIETY.

By A. LAWRENCE ROTCH.

The triennial meeting of this society, which was held at Frankfort on the Main this year between April 14 and 16, was attended by about twenty-five members. In the absence of the president, Prof. Dr. von Bezold, the vice-president, Prof. Dr. Neumayer, director of the Deutsche Seewarte, presided, and delivered an address on the progress of meteorology during the past twenty-five years, in which he advocated antarctic exploration as a means of advancing meteorology and terrestrial magnetism. Prof. Hergesell summarized the proceedings of the recent International Aeronautical Conference at Strassburg; Dr. Bergholz, of Bremen, spoke on the form of meteorological annuals and advocated the form adopted by the Potsdam Observatory; Mr. Polis, of Aix-la-Chapelle, discussed the circulation in areas of high and low pressure; Prof. Dr. Börnstein, of Berlin, with the aid of a model showing the monthly and daily periods, described the temperature conditions of that city, remarking that the mean of the daily extremes differed only 0.035° C. from the mean of the twenty-four hours; and Dr. L. Meyer, of Stuttgart, spoke on the daily changes of cloudiness in Hohenheim. Dr. Erk, of Munich, discussed the movements of the air in cyclones, as exemplified in Bavaria; Prof. Dr. Hellmann, of Berlin, recommended at secondary stations exposing the thermometers with no screens outside of the windows, but this was dissented from by other speakers; Prof. Hergesell described a sensitive recording metallic thermometer, constructed by M. Teisserenc de Bort. Dr. Knipping, now in charge of ocean meteorology at the Deutsche Seewarte at Hamburg, proposed a more extensive publication of extracts from ships' logs, which should help to equalize the much greater amount of data published for the land; and Prof. Max Möller, of Brunswick, discussed the relation of the pressure distribution to the horizontal temperature differences and friction. Prof. Dr. Sprung, of the Potsdam Observatory, described two of his new instruments; one was for taking, automatically and simultaneously, at two stations a series of photographs of clouds, in order to determine their height; the other was a rain and snow gauge, which weighed the precipitation and recorded it on the principle of his balance barograph. Prof. Dr. van Bebber, of Hamburg, in an analysis of the duration of sunshine in North America, stated that the amount of sunshine increases rapidly toward the south, as in Europe, and reaches a maximum in Arizona. Like Europe, the mountains receive the most morning sunshine, but, unlike Europe, the annual maximum in America occurs in the north in July and in the south in June. The speaker inferred that the characteristics of the northern and southern people are to be attributed to climatic conditions, and especially to the duration of sunshine. Prof. Dr. Neumayer exhibited charts of terrestrial magnetism and pointed out where observations were desired; Dr. Gerstmann, of Berlin, said that the importance to fruit growers of being able to predict frosts at night demanded that suitable dew-point tables be prepared.

No reports of the proceedings were published, except in the newspapers, but it is probable that many of the papers will appear in the Meteorologische Zeitschrift. Prof. Dr. Neumayer, having resigned his position as vice-president of the Society, which he helped to create in 1883, was chosen an honorary member. The same honor was conferred on General Rykatcheff, director of the Physical Central Observatory at St. Petersburg. The following meteorologists were elected corresponding members of the society: Paulsen, of Copenhagen; Snellen, of Utrecht; von Konkoly, of Budapest; Hepites, of Bucharest; Rotch, of Boston; Pernter, of Vienna; Sapper, of Guatemala; and Lancaster, of Brussels.

CLIMATIC DATA BEARING UPON THE CULTURE OF THE DATE PALM.

By A. J. HENRY, Chief of Division.

Mr. Alfred A. Wheeler, of 1220 Jackson street, San Francisco, Cal., writes to the Chief of Weather Bureau, under date of May 20, 1898, requesting certain climatic data for Arizona for use in a comparative study of the climates adapted to the culture of the date palm. Mr. Wheeler states, among other things, that—

It is not sufficient for date culture that one should know the minimum temperature of any month. The facts of importance are: (1) the minimum, (2) the mean of minima, (3) the times of temperatures at 32° or below. This record for the six months from November 1 to May 1 gives a Night Frost Table that is all sufficient; for everybody knows there is no duration of low temperature lasting into daytime in the horticultural parts of either California or southern Arizona. Similarly, from May 1 to November 1, the converse record, giving the coefficient of heat, is what the date grower will require, viz, (1) the maximum, (2) the mean of maxima, (3) the times of temperature at 90° or above. The date blooms in Arizona and California from April 15 to May 15, according to season and locality, and this Heat Table would cover its whole period from blooming to ripening. As date culture is on the verge of becoming an industry in Arizona and California, both of these tables would be of great value there; and the utility of the frost table would apply equally to Florida, since there, as in California, the growing of citrus fruits is the object of an established commerce. I hope the Weather Bureau will agree with me that it is important to tabulate climatic facts for regions like California, Arizona, and Florida, different from those which are of interest elsewhere, where the forms of horticulture are determined by other conditions.

The information collected for Mr. Wheeler is published herewith for the benefit of readers of the REVIEW.

Table of maximum temperatures at Phœnix, Ariz.

Year.	Month.	Maximum.	Mean maxima.	No. of hours with temperature 90° or above.	Year.	Month.	Maximum.	Mean maxima.	No. of hours with temperature 90° or above.
		°	°				°	°	
1895 ...	August	110	101.4	268.0	1896 ..	October	98	83.3	39.5
1895 ...	September ...	107	97.0	221.0	1897 ..	May	104	93.8	175.5
1895 ...	October	93	85.9	36.5	1897 ..	June	107	98.6	247.5
1896 ...	May	110	89.6	79.0	1897 ..	July	107	103.1	379.5
1896 ...	June	115	105.1	396.5	1897 ..	August	110	102.0	339.0
1896 ...	July	109	100.2	300.5	1897 ..	September ...	102	95.8	173.0
1896 ...	August	108	100.7	323.0	1897 ..	October	100	82.1	22.5
1896 ...	September ...	104	95.5	197.5					

Table of minimum temperatures at Phœnix, Ariz.

Year.	Month.	Minimum.	Mean minima.	No. of hours with temperature 32° or below.	Year.	Month.	Minimum.	Mean minima.	No. of hours with temperature 32° or below.
		°	°				°	°	
1895 ...	November ...	34	44.6	0.0	1897 ..	February	30	39.4	6.0
1895 ...	December ...	23	34.8	72.0	1897 ..	March	31	41.3	1.5
1896 ...	January......	30	39.2	16.5	1897 ..	April	38	51.6	0.0
1896 ...	February	28	41.1	17.5	1897 ..	November ...	31	44.0	2.5
1896 ...	March	34	48.4	0.0	1897 ..	December ...	23	33.6	56.0
1896 ...	April	38	48.7	0.0	1898 ..	January......	23	36.5	76.5
1896 ...	November ...	32	55.8	1.0	1898 ..	February	36	43.8	0.0
1896 ...	December ...	33	39.7	0.0	1898 ..	March	33	43.2	0.0
1897 ...	January......	27	40.5	10.5	1898 ..	April	41	56.8	0.0

TEMPERATURES OBTAINED BY KITES AT BERGEN POINT, N. J.

By HENRY L. ALLEN (dated April 14 and May 2, 1898).

Mr. Henry L. Allen, of Bayonne, N. J., communicates the following table of results of his observations of the temperature of the upper air taken by means of thermometers carried up by kites of the Eddy pattern.

This work has been done essentially by Mr. Allen, but occasionally assisted by Mr. William A. Eddy, Mr. W. W. Hotchkin, and others, and by Mr. J. H. Eadie, local observer in the New Jersey State Weather Service, who contributed the average daily temperature at the surface of the ground given for comparison in the last three columns.

Simultaneous observations with kites at New York, N. Y., and Bayonne, N. J., were made on April 9, 1898.

For the sake of comparison the temperatures observed by Mr. Allen occasionally at the surface of the earth at Bayonne, at the beginning and end of the ascensions, have been given in columns 8 and 9. The Editor has also added, in columns 12, 13, 14, and 15, the temperatures at the beginning and ending, and the winds prevailing during the time of each ascension, as observed at the Weather Bureau station in New York City, where the Weather Bureau thermometer was 298 feet above ground and 314 above sea level, during this series of observations. This Weather Bureau station is 11 miles northeast of Bayonne, the greater part of the intervening region is occupied by New York harbor. Mr. Allen says:

In November, 1896, I purchased a Six's registering thermometer, with a 10-inch wood back. Those incased in tin were not desirable on account of weight. The brown pasteboard box, which came with it, was turned into a protector for the thermometer during its aerial trips, by cutting windows, folding inward, in three sides of the box, to secure a circulation of air, and still shade it from the sun. But only a few of the ascensions have been taken when the sun was shining, and some at night with the thermometer exposed.

For an ascension the thermometer was tied into the box, temperature and time noted, and then a sling of two loops of string fastened around the closed box, with two rubber bands around all for safety. This sling holding the thermometer box was then fastened into the kite line about 100 feet below the kite, then the time of its leaving the ground noted and line paid out, carrying up the thermometer to the required altitude. My thermometer is *not* fastened to the kite. My reason for this is that if the thermometer was fastened to the kite, the record might be destroyed by a quick dive made by the kite in very strong winds; suspending the thermometer below the kites insures safety from that source, as the line would gently sway from side to side, carrying the thermometer with it, and not exposing it to the destroying influence of the dive.

When the ascensions have been made at night, I have usually had on the line a light to which the altitude is triangulated, otherwise the triangulation is made to the kite, and the distance between the kite and thermometer subtracted from that altitude. Lanterns have never been put near enough to the thermometers to spoil the record.

The maximum temperature is usually that at the ground, but sometimes as the thermometer ascends it has passed through a warm stratum sending the mercury up from 1° to 3°, and then falling to the minimum at the highest point. Ascension No. 13 is the only exception. Then the maximum was at the highest elevation, and the minimum at the earth.

In regard to the average temperatures noted by me on the three days given in the table, I wish to state that my thermometer was placed on the western side of the house, between the blinds and window glass, and in the afternoon it received the radiated heat of the sun, and, therefore, I use Mr. Eadie's. The trouble was not with my thermometer but its position. But beginning with April 1, 1898, my thermometer was placed in a shelter on the north side of the house, and the instruments hung about 1 foot from the wall of the house. In the record of the ascension of April 9, 1898, you will notice that my averages compare better.

Up to May 1, 1898, all of my temperature records have been taken with the same Six's thermometer that was used in the ascensions. But hereafter my record for the shelter will be taken from a fine glass Six's thermometer, which has been carefully tested and regulated by the maker.

I can not explain why the maximum and minimum temperatures of the kite record are the same as those at the earth, further than saying that the temperature was falling equally from the surface of the earth to about 400 feet above the earth on those occasions.

My records are taken between Fourth and Fifth streets, while Mr. Eadie's are taken at Thirty-sixth street, this section of the city being known as Bergen Point. The distance between my kite field and Mr. Eadie's house is about 2.25 miles.

Ascensions Nos. 12, 13, 14, and 15 were made by Mr. Eddy for me, with his and Mr. Hotchkin's thermometers, but I assisted during the ascension.

Record of thermometer ascensions made at Bergen Point, Bayonne, N. J., by Henry L. Allen.

Number.	Ascension. Date.	P. M. Began.	P. M. Ended.	Kite record. Altitude.	Kite record. Temperature. Max.	Kite record. Temperature. Min.	Local conditions. Temperature. Beginning.	Local conditions. Temperature. Ending.	Local conditions. Wind.	Local conditions. Sky.	New York. Temperature. Beginning.	New York. Temperature. Ending.	New York. Winds during ascensions. Direction.	New York. Winds during ascensions. Velocity.	Average daily temperature observed by Mr. Eadie. Same day.	2d day.	3d day.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
		H. M.	H. M.	Feet.	°	°	°	°			°	°			°	°	°
1	November 24, 1896.	9 00	9 45	375	64	50	....	....	w. 4	Clear.	54	53	nw.	12	52.5	44	51
2	December 10, 1896..	8 00	9 00	400	54	44	....	....	s. 2	Clear-cloudy.	47	47	s.	4	47.5	41.5	39.5
3	December 25, 1896..	4 45	5 15	500	38	26	....	....	s. 4	Clear.*	28	27	sw.	15	22.5	25.5	21.5
4	January 30, 1897...	4 45	5 15	825	40	27	....	....	w. 4	Clear.*	29	29	nw.	12	26	23.5	21.5
5	March 8, 1897.....	8 55	9 25	300	41	34	....	....	e. 2	Clear.	33	32	e.	6	30.5	39	49
6	April 10, 1897.......	4 10	4 30	200-300	57	52	....	....	w. 4	Clear.	51	50	nw.	19	49.5	48.5	46
7	June 16, 1897.......	7 25	7 55	600	70.5	70	....	....	w. 3	Clear.	75	74	nw.	16	70.5	63	70.5
8	August 10, 1897....	8 15	10 15	925	72	67	....	....	se. 3	Cloudy.	70	69	se.	12	72	75.5	74
9	September 4, 1897.	8 45	10 10	700-800	65	60	....	....	s. 3-1	Clear.	65	65	nne.	10	66	71	77
10	September 17, 1897.	1 30	1 45	300	79.5	76	....	....	nw. 5	Clear-pt. cloudy.	77	77	nw.	25	74	60	63.5
11	September 25, 1897.	8 30	12 00	1,510	66	58	....	....	sw. 2	Clear.	67	62	ssw.	9	68.5	69	63.5
12	October 9, 1897.....	8 30	10 30	600	50	46	....	....	n. 4	Clear.	49	46	nw.	18	60.5	49	58.5
13	October 16, 1897....	8 44	10 10	436	74	70	70	....	sw. to w. 5	Clear.	75	73	sw.	26	76.5	63	48
14	October 23, 1897 † ..	7 00	10 40	1,810	51 / 49	50 / 47	....	....	e. 3	Cloudy.	51	50	e.	9	52.5	47	53
15	October 30, 1897 † ..	7 20	8 15	270	43 / 38	39 / 34	40	....	n. 4	Clear.	42	42	nw.	15	46	44.5	54
16	January 27, 1898....	7 40	8 20	350-400	40	28	38	....	wnw. 2	Cloudy.	32	31	nw.	8	30.5	25	22
17	February 7, 1898...	7 30	8 05	300	39	36	....	....	ssw. 2	Cloudy-clear.	39	39	se.	6	34	32	34
18	February 12, 1898..	8 50	9 25	300	44	42	44	....	nw. 3	Clear-pt. cloudy.	46	45	nw.	10	45	43.5	37
19	March 12, 1898	8 20	9 35	220	62	58	62	58	s. 4	Cloudy.	53	55	s.	18	55.5	57	51
20	March 19, 1898	4 45	5 35	390	72	67	72	67	s. 4	Partly cloudy.	69	68	sw.	16	59	63	43
21	April 9, 1898........	4 40	5 40	400	51	45	51	47	s. 3	Cloudy.	47	47	....	12	44.5	51	49.5
	April 9, 1898 ‡	5 25	5 45	660	49	45	49	47	sse. 3	Cloudy.	....	....	....	....	....	....	....
22	April 23, 1898... ...	4 40	5 45	400	67	62	66	61	sse. ..	Partly cloudy.	63	61	se.	9	62	60	51.5
23	April 30, 1898.......	9 15	10 00	370	59	56	56	57	wnw. ..	Clear to cloudy.	62	60	nw.	8	....	....	....

*Snow on ground. † Two thermometers sent up on line. ‡ Ascension at the Postal Telegraph Building, New York City, by William A. Eddy and W. W. Hotchkin.

RAINFALL OF MASAYA AND GRANADA, NICARAGUA.

By A. J. HENRY, Chief of Division.

Dr. Earl Flint, for many years voluntary observer of the Smithsonian Institution and the Signal Service, and the present correspondent of the Weather Bureau for Rivas, Nicaragua, furnishes the following table of rainfall, as observed by Mr. Cline.

Masaya is in latitude 12° 2′ N., longitude 86° W.; Granada is in latitude 12° N., longitude 85° 56′ W. Observations were made by Mr. William Cline, civil engineer, at Masaya, from 1886 to 1896, and at Granada for the remainder of the time. Nothing is known of the kind of gauge used or its exposure, but from the professional standing of the observer and the general agreement between the recorded amounts and those obtained by Dr. Flint at Rivas (latitude 11° 26′ N., longitude 85° 47′ W., elevation, 200 feet above sea level), it is concluded that the series is reliable.

The rainy season at Masaya, as elsewhere in Nicaragua, begins in May and ends in the latter part of October. December, January, February, and March are almost destitute of rain, less than 2 per cent of the annual fall occurring in those months.

The greatest fall in any year was at Granada, in 1897 93.62 inches, or 162 per cent of the mean fall; the least fall of any year was at Masaya, in 1890, 20.52 inches, but 35 per cent of the mean fall. Such a disproportion between the amount of rain in the year of minimum rainfall and the mean is rarely observed. The variation in the fall of the same month in different years is even greater. The short dry season in the middle of summer, which is a characteristic of the rainfall of portions of Central America, is not well marked at Masaya; in some years heavy rain is continuous from May to November.

Monthly and annual amounts of rainfall at Masaya, 1886–1896, and Granada, 1897, Nicaragua, in inches and hundredths.

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
1886 ...	......	......	......	*	......	......	8.23	15.26	15.34	11.19	0.69	0.02	*72.70
1887 ...	0.30	0.00	0.00	0.00	2.42	10.73	7.39	5.74	9.15	23.56	0.94	0.99	61.22
1888 ...	0.05	0.14	0.00	0.00	7.09	12.09	4.95	9.50	17.21	7.67	0.00	0.00	58.70
1889 ...	0.00	0.00	2.39	1.18	6.43	17.00	7.87	13.43	14.53	13.36	2.34	0.25	78.78
1890 ...	0.14	0.00	0.00	0.60	1.82	3.00	2.86	2.66	2.95	5.89	0.42	0.18	20.52
1891 ...	0.19	0.00	0.00	1.02	0.48	20.94	4.52	4.20	10.40	5.45	2.78	0.00	49.98
1892 ...	0.00	0.00	0.00	0.00	7.36	14.42	8.70	6.75	9.64	15.71	1.66	0.30	64.54
1893 ...	0.00	1.15	0.00	0.00	9.26	11.78	11.47	15.82	12.67	6.51	2.70	1.50	72.86
1894 ...	0.32	0.50	0.00	0.00	7.87	4.77	3.32	4.00	7.49	13.42	1.08	0.11	42.88
1895 ...	0.00	0.00	0.00	0.41	4.57	4.71	5.22	2.90	8.36	14.46	0.57	0.06	41.26
1896 ...	0.23	0.00	0.00	0.09	5.62	7.90	7.13	2.98	6.62	4.22	4.85	0.00	39.64
1897 ...	0.00	0.00	0.97	1.77	16.63	30.79	8.88	10.87	10.21	11.97	1.25	0.28	93.62
Means	0.11	0.16	0.31	0.46	6.32	12.56	6.71	7.84	10.38	11.12	1.61	0.31	57.89

* The estimated rainfall January to June, 1886, inclusive, was 21.97.

It is hoped to soon publish a complete record of the monthly and annual amounts of rain at Rivas for the period 1880–1897.

METEOROLOGICAL OBSERVATIONS AT RIVAS, NICARAGUA.

The records contributed for many years by Dr. Earl Flint, at Rivas, Nicaragua, include barometric readings. His present station is at 11° 26′ N., 85° 47′ W. The observations at 7:17 a.m., local time are simultaneous with Greenwich 1 p.m. The altitude of his barometer is 36 meters above sea level, but until the barometer has been compared with a standard it seems hardly necessary to publish the daily readings. The wind force is recorded on the Beaufort scale, 0–12. When cloudiness is less than $\frac{1}{10}$, the letter "F," or "Few," is recorded.

On his forms for December Mr. Flint states that the total annual rainfall for 1897 was 123.43 inches, or the greatest during the eighteen years of his observations.

His station is situated on the western shore of Lake Nicaragua, not far from the eastern end of the western division of the Nicaragua Canal. The volcano Ometepe, on an island in Lake Nicaragua, is about 10 miles northeast of his station. Mr. Flint's records occasionally mention the presence of clouds in the early morning on the summits of this mountain.

Observations at Rivas, Nicaragua, March, 1898.

OBSERVATIONS AT 7 A. M.

Date.	Temperature.		Wind.		Upper clouds.			Lower clouds.			Daily rainfall.
	Air.	Dew-point.	Direction.	Force.	Kind.	Amount.	Direction from.	Kind.	Amount.	Direction from.	
	°	°									
1	75	63	ne.	2	c.	Few	sw.		0		0.00
2	76	70	ne.	1				ks.	10	ne.	0.00
3	76	71	se.	0	c.	1	sw.	ck.	3	ne.	0.00
4	79	71	ne.	0				ck.	10	ne.	0.00
5	78	72	ne.	3-5				ck.	10	ne.	0.00
6	77	72	ne.	3	c.	2	sw.	ks.		ne.	0.00
7	77	72	ne.	2		0		ks.	9	ne.	0.04
8	75	70	ne.	3-4		0			0		0.00
9	74	68	ne.	2-3	c	Few	sw.		0		0.00
10	76	65	ne.	2	cs.	5	sw.	ks.	1	ne.	0.00
11	76	69	ne.	0-5	c.	1	ne.	ks.	2	ne.	0.00
12	76	72	ne.	1	c.	Few	sw.		0		0.00
13	76	70	ne.	1		0		ck.	3	ne.	0.00
14	77	71	ne.	1		0			0		0.00
15	77	70	ne.	1		0		ck.	1	ne.	0.00
16	76	70	ne.	1	c.	8	nw.		0		0.00
17	76.5	69	ne.	2	c.	10	se.		0		0.00
18	76	68	ne.	1		0		ks.		ne.	0.00
19	75.5	67	ne.	2-3		0			0		0.00
20	77	67	ne.	2		0			2		0.00
21	77	70	ne.	1	ck.	6	ne.		0		0.00
22	76	68	ne.	1	cs.		sw.	ks.	3	ne.	0.00
23	76.5	67	ne.	2		0		ks.	10	ne.	0.00
24	77	68	ne.	1		0		ks.	2	ne.	0.00
25	77	70	ne.	1		0			0		0.06
26	75.5	70	ne.	3		0		ks.		ne.	0.00
27	76	67	ne.	2		0		ks.		ne.	0.00
28	77	70	ne.	1		0		ks.		ne.	0.00
29	76	70	ne.	1		0		ks.		ne.	0.00
30	76	67	ne.	1	c.	2	sw.	ks.		ne.	0.00
31	77	70	ne.	2	ck.	5	ne.		0		0.00
Means	76.4										0.10

OBSERVATIONS AT 8 P. M.

Date.	Temperature.		Wind.		Upper clouds.			Lower clouds.		
	Air.	Dew-point.	Direction.	Force.	Kind.	Amount.	Direction from.	Kind.	Amount.	Direction from.
	°	°								
1	76	71	ne.	2	ck.	0	se.		0	
2	80	73	se.	0		0			0	
3	81	77	se.	0		0		ks.	10	se.
4	80	73	se.	1	c.	10	se.		0	
5	80	72	ne.	3	c.	10	se.		0	
6	80	72	ne.	3		0			0	
7	78	71	ne.	3	ck.	7	ne		0	
8	79	72	ne.	2	ck.	6	ne.		0	
9	78	72	ne.	1		0			0	
10	78	73	ne.	1	c.		ne.		0	
11	79	72	ne.	1		0			0	
12	79	74	ne.	0		0			0	
13	79	73	ne.	0.5		0			0	
14	81	74	ne.	2		0			0	
15	80	73	ne.	1		0			0	
16	79	72	ne.	2		0			0	
17	80	73	ne.	2		0			0	
18	79	72	ne.	3		0			0	
19	79	72	ne.	2		0			0	
20	79	69	ne.	2		0			0	
21	80	72	ne.	2		0			0	
22	80	72	ne.	2		0			0	
23	79	71	ne.	2		0			0	
24	77	70	ne.	1		0			0	
25	77	70	ne.	2		0		ks.	10	ne.
26	80	71	ne.	2		0			0	
27	78	71	ne.	1	ck	Few	ne.		0	
28	81	73	ne.	1	ck.	5	ne.		0	
29	77	73	ne.	2		3	ne.		0	
30	81	71	ne.	2		0			0	
31	80	72	ne.	2		0			0	
Means	79.2									

OBSERVATIONS AT HONOLULU, REPUBLIC OF HAWAII.

Through the kind cooperation of Mr. Curtis J. Lyons, Meteorologist to the Government Survey, a copy of the daily record at Honolulu is communicated to the Weather Bureau in advance of its official publication, and is herewith printed, as a special contribution, for the convenience of those who are studying the relations of the storms and weather of the United States to those of adjacent countries, with a view to long-range, seasonal predictions.

Meteorological observations at Honolulu, Republic of Hawaii.

The station is at 21° 18′ N., 157° 50′ W.; altitude 50 feet.
Pressure is corrected for temperature and reduced to sea level, but the gravity correction, —0.06, is still to be applied.
The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 10. Two directions of wind, or values of wind force, connected by a dash, indicate change from one to the other.
The rainfall for twenty-four hours is given as measured at 6 a. m. on the respective dates.

APRIL, 1898.

April, 1898.	Pressure at sea level.			Temperature.					Relative humidity.			Wind.		Cloudiness.	Rain measured at 6 a. m.
	7 a. m.	3 p. m.	9 p. m.	6 a. m.	2 p. m.	9 p. m.	Maximum.	Minimum.	7 a. m.	2 p. m.	9 p. m.	Direction.	Force.		
1	30.17	30.08	30.15	67	73	69	74	63	71	57	72	ne.	5	3-5	0.04
2	30.12	30.04	30.09	68	73	70	76	67	68	61	68	ne.	4	3-7	0.04
3	30.08	30.03	30.10	69	73	70	75	65	64	61	72	ne.	4	4	0.23
4	30.13	30.08	30.15	69	74	70	75	68	68	58	70	ne.	3-5	3-5	0.02
5	30.16	30.11	30.22	68	73	68	75	66	72	59	77	ene.	4	4-7	0.03
6	30.20	30.14	30.20	68	74	70	75	66	72	58	64	ne.	3	3-1	0.06
7	30.13	30.06	30.14	66	74	67	76	62	71	66	85	nne.	3-2	3-8	0.00
8	30.07	30.02	30.11	67	72	69	76	65	72	62	76	ne.	3-1	3-8	0.20
9	30.09	30.04	30.13	67	75	71	76	65	83	63	72	ne.	3	5-3	0.16
10	30.12	30.07	30.19	68	76	71	79	64	72	63	70	ne.	3	3	0.10
11	30.16	30.15	30.20	67	75	71	78	65	77	68	72	ne.	4	3-8	0.00
12	30.20	30.15	30.24	66	69	67	71	65	95	81	92	nne.	3-5	8	0.34
13	30.18	30.12	30.20	67	74	71	76	64	81	66	72	ne.	3	6-2	0.80
14	30.15	30.06	30.14	67	75	70	76	66	81	66	72	ne.	3-5	6-3	0.09
15	30.12	30.08	30.16	69	75	72	77	68	77	68	72	ne.	3	4-2	0.01
16	30.12	30.08	30.16	70	76	71	79	68	71	66	77	ne.	3	2-5	0.01
17	30.13	30.07	30.15	68	77	72	79	64	77	59	73	ne.	3	4-2	0.00
18	30.11	30.06	30.11	68	76	71	78	67	72	59	73	ne.	3	3	0.00
19	30.12	30.05	30.15	68	76	72	77	67	72	61	69	ne.	4	4	0.05
20	30.12	30.07	30.13	70	76	71	77	67	69	55	75	ne.	4	5-1-3	0.07
21	30.10	29.98	30.07	68	77	67	78	66	85	59	80	ne-w.	2-0	3-1	0.13
22	30.05	30.02	30.09	64	77	70	78	62	80	65	83	w.	1	0-3	0.01
23	30.08	30.01	30.10	64	77	71	79	63	85	67	85	sw-e.	1	1	0.01
24	30.10	30.02	30.12	66	78	70	80	64	82	63	81	sw-e.	1	1-5	0.00
25	30.08	30.00	30.09	66	79	73	80	64	77	55	75	nne.	1-3	2	0.02
26	30.07	30.00	30.07	71	80	73	81	70	74	55	74	ne.	1-3	2	0.00
27	30.04	29.97	30.05	69	80	70	81	65	78	57	80	nne.	0-3-0	5-1	0.00
28	30.03	29.96	30.04	63	79	71	80	63	73	60	83	se-s-sw.	1	2	0.00
29	30.04	29.99	30.04	66	79	73	82	65	80	68	80	sw-n.	1	2-7	0.00
30	30.02	29.95	30.04	70	78	71	79	66	78	63	77	nne.	3-0	4-2	0.00
	30.11	30.05	30.13	67.5	75.7	70.4	77.4	65.3	75.9	65.6	75.7	....	2.6	3.9	2.42

METEOROLOGICAL OBSERVATIONS AT PORT AU PRINCE, HAITI.

Through the kind cooperation of Prof. T. Scherer of Port au Prince, Haiti, the meteorological observations taken by him at 7 a. m., local time, or 11:49 a. m., Greenwich time, are communicated in manuscript for early publication in the MONTHLY WEATHER REVIEW. By entering these on the monthly and annual charts, published by the Weather Bureau, we obtain an important extension southeastward of our field of study. The observations are taken $1^h\ 11^m$ earlier than those of the Weather Bureau telegraph system. The original reports are in metric measures; the conversions are by the Editor.

The barometer is 119 feet above sea level; its readings have been corrected by Professor Scherer for temperature, elevation, and gravity, this latter correction is —0.064 inch; the thermometers are 6.7 feet above ground; the rain gauge, 7.2 feet above ground. The wind velocity is given in miles per hour.

The position of Port au Prince, Haiti, is latitude 18° 34′ N., longitude 72° 21′ W., or $4^h\ 49^m$ west of Greenwich. Additional records for this station are published in the annual volume of the Central Meteorological Institute at Vienna.

Observations at Port au Prince, Haiti.

APRIL, 1898.

Date.	Barometer reduced.	Temperature.		Rel. humidity.	Wind.		Clouds.			Preceding 24 hours.		
		Air.	Dew-point.		Direction.	Velocity.	Kind.	Amount.	Direction.	Total rain.	Temperature. Max.	Temperature. Min.
	Inches	°	°	%						Inch.	°	°
1	30.08	73.0	60.3	66	se.	4	cs	4	sw.	0.00	90.3	68.4
2	30.08	75.4	59.4	60	e.	11	k	6	ne.	0.00	91.0	70.2
3	30.04	75.2	65.8	74	......	0	k	4	ese.	0.00	88.5	71.6
4	30.06	75.6	63.9	67	......	0	....	0	....	0.00	93.2	71.4
5	30.10	76.3	62.2	64	e.	9	....	0	....	0.00	92.7	70.0
6	30.14	76.1	55.9	51	ese.	7	cs	1	....	0.00	94.6	70.3
7	30.09	74.8	54.5	51	......	0	cs; k	3	....	0.00	89.2	69.3
8	30.03	75.2	68.9	82	......	0	k	7	w.	0.02	89.6	71.2
9	30.09	76.8	65.8	70	ese.	2	k	3	....	0.05	91.0	71.8
10	30.12	76.6	63.3	65	ese.	2	....	0	....	0.00	90.0	70.7
11	30.12	75.6	67.8	77	......	0	cs k	 1	wsw. w.	0.00	90.9	70.9
12	30.10	76.5	63.3	65	......	0	k	5	ne.	0.99	88.9	71.4
13	29.99	75.0	69.4	84	ese.	4	....	0	....	0.00	90.3	70.5
14	29.99	77.2	69.4	78	ese.	2	k	6	e, nw.	0.02	91.0	72.7
15	30.02	76.6	63.9	66	e.	9	cs	1	....	0.00	92.1	72.1
16	30.06	75.0	66.7	77	......	0	....	0	....	0.00	90.5	69.6
17	30.10	75.9	72.9	90	......	0	n	10	....	0.18	87.4	72.5
18	30.08	73.9	58.6	61	......	0	....	0	....	0.06	90.0	69.6
19	30.06	77.2	70.2	80	ese.	2	fk	9	nw.	0.00	92.5	72.1
20	30.04	77.2	64.2	66	......	0	cs	1	....	0.05	90.1	69.6
21	30.06	78.4	70.7	74	......	0	k	2	ne.	0.00	89.4	73.2
22	30.08	78.4	61.7	59	se.	4	k	2	e.	0.00	92.5	72.7
23	30.04	79.2	66.7	67	ese.	9	k	1	n.	0.00	95.2	75.0
24	30.02	79.3	63.7	60	ese.	11	....	0	....	0.02	94.1	72.3
25	30.08	78.4	63.5	58	e.	9	k	3	n.	0.28	92.8	72.3
26	30.13	77.2	70.0	79	......	0	k	3	....	0.65	87.6	71.8
27	30.06	72.1	68.2	88	......	0	n	10	....	0.00	86.9	68.9
28	29.95	77.2	69.6	79	ese.	4	k	1	....	0.00	88.7	71.8
29	30.00	77.9	66.6	70	se.	7	cs; k	1	ne.	0.00	93.0	70.3
30	30.05	78.6	68.2	72	......	0	sk	1	....	0.93	91.0	74.1
Sum	......	......	......	......	......	....	....	....	....	3.23	......	......
Means.	30.06	76.5	65.1	69.8	......	....	....	....	....	.....	90.9	71.2

fk = fracto cumulus. n = nimbus.

MEXICAN CLIMATOLOGICAL DATA.

Through the kind cooperation of Señor Mariano Bárcena, Director, and Señor José Zendejas, vice-director, of the Central Meteorologico-Magnetic Observatory, the monthly summaries of Mexican data are now communicated in manuscript, in advance of their publication in the *Boletin Mensual;* an abstract translated into English measures is here given in continuation of the similar tables published in the MONTHLY WEATHER REVIEW during 1896. The barometric means have not been reduced to standard gravity, but this correction will be given at some future date when the pressures are published on our Chart IV.

Mexican data for April, 1898.

Stations.	Altitude.	Mean barometer.	Temperature.			Relative humidity.	Precipitation.	Prevailing direction.	
			Max.	Min.	Mean.			Wind.	Cloud.
	Feet.	Inch.	° F.	° F.	° F.	%	Inch.		
Leon(Guanajunto)..	1,809	24.30	88.5	47.5	68.4	56	0.46	ssw.	†
Linares (New Leon)..	1,188	28.76	98.6	52.7	77.7	69	2.44	se.	se.
Magdalena (Sonora).	2,618	....	....	....	78.8	....	1.10	s.	n.
Mazatlan	25	29.94	82.6	61.0	72.9	79	0.06	nw.	sw.
Merida (Yucatan) ...	50	29.94	99.0	61.2	79.9	64	1.56	ne.	se.
Mexico (Obs. Cent.)..	7,472	23.08	88.7	39.2	62.4	55	2.06	nw.	sw.
Morelia (Seminario)..	6,401	23.97	85.5	51.4	67.6	52	T.	wsw.	w.
Oaxaca	5,164	25.08	93.2	50.4	71.8	55	3.03	*	e.
Puebla (Col. Cat.)....	7,112	23.36	82.4	40.1	64.4	62	1.03	e.	s.
San Luis Potosi.....	6,202	24.13	85.8	42.8	67.2	53	0.93	se.	w.
Tuxpan (Vera Cruz).	....	....	93.6	61.2	76.1	88	2.00	ne.	s.
Tuxtla G. (Chiapas)..	1,864	28.13	100.8	61.5	80.8	62	0.11	nnw.	s.
Zacatecas	8,015	22.50	83.8	39.9	62.4	40	0.71	nnw.	w.
Zapotlan (Seminario)	5,078	....	91.0	50.0	73.8	39	0.01	sse.	sw.

* w., nnw., nw. † wsw., nne.

NOTES BY THE EDITOR.

THE RAINFALL AND OUTFLOW OF THE GREAT LAKES.

In a complete study of the rainfall over the Great Lakes, the variations in their surface levels, and the eventual discharge at the respective outlets, the following items have to be considered:

(*a*) The total amount and distribution throughout the year of the rainfall and melted snow on the lake surface.

(*b*) The run off from the watershed into the lake, which, of course, depends upon the rainfall and snowfall minus the evaporation and consumption.

(*c*) Evaporation from the lake surface itself.

(*d*) The outflow or discharge from the lake.

(*e*) The effect of the current winds in temporarily changing the level, and also the effect of the average wind in permanently changing the level of the water.

(*f*) The small variable effects of solar and lunar tides, changes of the earth's axis, variations of barometric pressure, varying temperature, and density of the water.

(*g*) The secular changes due to gradual geological changes by which the earth's surface is being slowly tipped in one direction or another,[1] as also those due to silting up of the shallow and quiet portions, and those due to the wearing away of the channels and banks. These secular changes may be appreciable in fifty years, but as compared with the variations of rain and snow, evaporation, and winds, they have no importance in annual means.

In general, the experience of the past three hundred years has shown that the surfaces of the various lakes have oscillated up and down through a range of several feet about a mean position that must represent very closely the normal balance between the annual income and outgo for the present century. So far as the atmosphere is concerned the normal *supply* is not likely to change, but the normal *outflow* is subject to considerable variations and to a slow secular increase that may eventually lower the levels of the surfaces of the lakes.

[1] According to Mr. G. K. Gilbert, there is at present going on a gradual change in inclination of the general surface of the land, by reason of which the whole Lake Region is, relatively speaking, sinking in its southwestern half and rising in its northeastern half. The following quotation is taken from an advance copy of the forthcoming report by Mr. Gilbert in the Annual Report of the Director of the United States Geological Survey:

"The land in this region is being slowly canted toward the south-southwest, and the rate of change is such that the two ends of a line 100 miles long and lying in a south-southwest direction are relatively displaced by four-tenths of a foot in 100 years. The waters of each lake are gradually rising on the southern and western shores, or falling on the northern and eastern shores, or both. This change affects the mean height of the lake surface. In Lake Ontario the water is advancing on all shores, the rate at any place being proportional to the distance from the isobase through the outlet. At Hamilton and Port Dalhousie it amounts to 6 inches in a century. The water also advances on all shores of Lake Erie, most rapidly at Toledo and Sandusky, where the change is 8 or 9 inches per century. All about Lake Huron the water is falling most rapidly at the north and northeast, where the distance from the Port Hudson isobase is greatest. At Mackinac the rate is 6 inches, and at the mouth of French River, 100 inches per century. On Lake Superior the isobase of the outlet cuts the shore at the international boundary; the water is advancing on the American shore and sinking on the Canadian. At Duluth the advance is 6 inches, and at Heron Bay the recession is 5 inches per century. The shores of Lake Michigan are divided by the Port Hudson isobase. North of Oconto and Manistee the water is falling. South of those places it is rising, the rate at Milwaukee being 5 or 6 inches per century, and at Chicago 9 or 10 inches. Eventually, unless a dam is erected to prevent, Lake Michigan will again overflow to the Illinois River, its discharge occupying the channel carved by the outlet of a pleistocene glacial lake. The summit in that channel is now 8 feet above the mean level of the lake, and the time before it will be overtopped (under the stated assumption as to the rate of tilting) may be computed."

A satisfactory study of important points relative to this subject would require an elaborate collection of new data and its consideration from this special point of view, a work that will undoubtedly be carried out by the engineers of United States Deep Waterways Commission.

From the general climatological point of view it is believed that the most that can be said at the present time, as to the general régime of the lakes, may be condensed into the following text and tables.

The extensive tables published on pages 129–143, of the report of the United States Deep Waterways Commission, show the average elevation of the lake surface at numerous points, month by month, since accurate records began, generally about 1860. In order to understand the reason for the monthly variations it will be necessary to compile a table showing the rainfall and *accumulated* rainfall, month by month and year by year, over the lake surface; the same items as to evaporation from the lake surface; the same items as to run off from the watershed; finally, the same items as to outflow from the lakes, which latter, of course, varies principally with the height of the water at the outlet itself. At the present time we know none of these separate items with anything like the accuracy that is necessary and of course, therefore, we can only predict in a very general way the effect that will be produced by the addition of engineering works to the present natural system.

The outflow from each lake has been measured at several times and the results, as quoted by G. Y. Wisner (First Annual Convention of the International Deep Waterways Association, page 126), are as follows:

1.—Lake Superior, 86,000 cubic feet per second, or 36.74 inches in depth over the whole surface of Lake Superior per year.

2 plus 3.—Lake Michigan plus Lake Huron, 225,000 cubic feet per second, or 67.02 inches in depth per year. There is no sensible difference between these two lakes, and they must be treated as one.

2 plus 3 plus 4.—Lake Michigan plus Lake Huron plus Lake St. Clair, 230,000 cubic feet per second, or 67.00 inches per year.

5.—Lake Erie, 265,000 cubic feet per second, according to Mr. D. F. Henry, but 230,000 cubic feet per second according to Mr. Ruffner of the United States Engineers. The average of these is 250,000 which will be assumed as a mean annual outflow. According to the records in the Annual Report of the Chief of Engineers for 1893, p. 4367, the observations between December, 1891, and May, 1892, show the following large range, namely, 1891, December 24, at low water stage, 164,648 cubic feet per second, and 1892, May 23, at a high stage, 239,677 cubic feet per second. It would seem that a much longer series of observations is necessary in order to determine the normal discharge and that our adopted figures may easily be 10 per cent too large.

6.—Lake Ontario, 300,000 cubic feet per second.

As I do not know of any more accurate measurements of discharge and presume that all these figures will be revised in the next report of the United States Deep Waterways Commission, I will make these the basis of a preliminary computation. The details of the steps as we proceed down the chain of lakes are given in full in Table 1 and may be explained as follows:

LAKE SUPERIOR.

The map of annual normal distribution of rain and melted snow shows that about 31.2 inches of rain falls on the surface of the lake as well as on that of its watershed. Of this latter quantity about 25 per cent may be estimated as run off into the lake, the remainder is absorbed by the ground or evaporated into the air. This adds 7.8 inches in depth for the whole area of the watershed, but as the surface of the lake is smaller than that of the watershed, this is equivalent to 11.9 inches for the whole area of Lake Superior. As there

is no inflow from an upper lake this gives 11.9 + 31.2 = 43.1 inches in depth, as the annual supply over the whole surface. It is estimated that the annual evaporation takes off 15.0 inches, thus leaving 28.1 as a normal annual addition to the depth of the lake. If the lake is to maintain its level without change this available surplus must be counterbalanced by an equal outflow through the St. Mary's River. The actual outflow has been measured frequently, and as quoted above from Wisner, will first be assumed as 86,000 cubic feet per second. It is most convenient to convert this measured discharge per second into the corresponding depth of water run off from the whole lake during the year, which is easily done as follows: The observed or approximate discharge of Lake Superior in cubic feet per second, divided by the number of square feet in the surface of the lake, will give the equivalent linear depth by which the water must fall in one second, viz, 86,000/31,800 × 5,280 × 5,280; multiplying this by the number of seconds in a year, i. e., 86,400 × 365.25, we obtain the *annual* discharge expressed as a depth of water over the whole surface of the lake in feet (or multiplying by 12, in inches). The result is—for Lake Superior—36.736 inches, which we have inserted in line 13 in Table 1.

LAKE MICHIGAN + HURON.

Similarly the discharge of Lake Huron, or more properly Lake Michigan + Lake Huron, 22,500 cubic feet per second, becomes, in depth for the whole surface of the lake, 67.02 inches, as given in Table 1, line 13, for Michigan + Huron.

The surplus of 28.1 inches from Lake Superior when distributed over Michigan + Huron becomes 28.1 × 31,800 / 45,600, or 18.75 of an inch in depth. The total supply of Michigan + Huron is 50.95, adding the inflow, 18.75, and subtracting the evaporation, 21.60, we have an available surplus of 48.10. The measured outflow, 67.02, exceeds this in about the same ratio as for Lake Superior.

ERIE.

Assuming that the surplus from Michigan + Huron, increased by the annual supply minus the evaporation for Lake St. Clair, is the total annual inflow into Lake Erie, we have to spread the sum of these two items over the area of Lake Erie. The two items of inflow are respectively:

From Lake Michigan + Huron...... 48.75 × 45,600 / 10,000 or	221.4
From Lake St. Clair..................124.0 × 495 / 10,000 or	6.14
Total inflow..	227.5

This inflow into Lake Erie, added to its total supply and diminished by the annual evaporation, gives an available surplus of 263.5 inches in depth.

The measured outflow from Lake Erie is 250,000 cubic feet per second, with a large uncertainty, or 339.6 inches in depth annually, which as before is about 30 per cent in excess of the computed available surplus.

ONTARIO.

The surplus from Lake Erie, 263.5 multiplied by the ratio of the areas, viz, 10,000 / 7,450, gives 353.7 for the equivalent depth on Lake Ontario; this latter, increased by the supply and diminished by the evaporation, gives 389.1 as the available surplus from Lake Ontario.

The measured outflow from Lake Ontario is given as 300,000 cubic feet per second, or 547.0 inches in depth per year. This again is over 40 per cent in excess of the available surplus.

IN GENERAL.

We thus see that throughout the whole chain of lakes our computations of possible normal available surplus per annum, computed for estimated values of the normal annual rainfall and evaporation, and very crude estimates of the run off from the watersheds, have invariably given values that are decidedly too small as compared with the measured outflow. It is very hazardous to speculate on the reason for this systematic discrepancy. If there is any truth in the measured outflows, rainfalls, and evaporations, then we must attribute the discrepancy to our ignorance of the percentage of run off from the watersheds. But as the evaporation is only estimated and has not yet been measured there is at present no need of suggesting new hypotheses, such as underground springs, to explain the discrepancy.

We might diminish the estimated loss by evaporation by 10 per cent and increase the rainfall by 10 per cent, and diminish the measured outflow, on the assumption that it relates to special years and not to normal values. In fact, the whole computation ought to be made for the specific years for which we have measured outflows and rainfalls.

It will be worth while to repeat all the preceding computation on the assumption that the percentage of the run off is 50 in place of 25, and this I have done in the last column of Table 1. Of course, the agreement between surplus and outflow is in general much improved, but whether this is a correct step toward the solution of the difficulty can only be determined when we have accumulated much better and more numerous observations than we now have. It is safe to conclude that the meteorological data as to rainfall are at present more accurate than the engineering data, i. e., evaporation, run off, inflow, and outflow.

With regard to the specific question as to the influence of the canal at Chicago, as planned by the Sanitary Commission, I find that the engineer, L. E. Cooley, on page 361 of the first report of the I. D. W. A., accepts 10,000 cubic feet per second as the probable outflow at Chicago. The effect of this outflow on the general level of Lake Huron plus Michigan will, of course, be 10,000 / 225,000 by the present outflow, which is 67.02 linear inches in depth annually; the result is 3 inches, so that the future outflow will be 70 instead of 67 inches. The effect of this upon the depth of water of Michigan plus Huron, and on the outflow of Lakes St. Clair, Erie, and Ontario, will be barely appreciable and of no practical importance whatever, in comparison with the uncertainty, the variability, and the great importance of the rainfall and evaporation. This slight drain upon Lake Michigan will undoubtedly be supplied by Lakes Superior and Huron, without affecting the surface level of St. Clair or Erie by more than a small fraction of an inch.

The deepening of the channel through St. Clair and Detroit rivers will diminish the resistance to the flow of water, so that more will pass per second than before, provided "the head of water," namely, the difference in level between Huron and Erie, remains the same; but this will not be the case. The effect will be felt at first mostly in the very center of the channel, and the total annual discharge will at first be a little, namely, much less than 1 per cent, more than at present; it may increase from 230,000 to 232,000 cubic feet per second, or from 67.00 to 67.6 inches per annum, but the final result will be the same as if we opened a wider and easier communication between the two lakes, and they will come to the same level and act as one lake, just as Huron and Michigan do now. Therefore, it is that we have given a computation in Table 1 for the three lakes combined.

As the influence of these two proposed engineering improvements on the régime of the lake is so small compared with that of the natural forces at work, it is evident that it is especially important to accumulate and improve the climatological data, rainfall, and evaporation, barometric pressure, and winds, all of which affect the supply and the outflow. These are vastly more important to the general public than are the local engineering projects, and the latter may be prosecuted without fear of disturbing the natural status of affairs.

TABLE 1.—*The computed regimen of the Great Lakes.*

(1) LAKE SUPERIOR.

1. Area of watershed, square miles	48,600	.....
2. Area of water surface, square miles	31,800	.....
3. Factor: Watershed / lake surface	1.528	.....
4. Annual rainfall on watershed, inches	31.2	.....
5. Average run off, percentage	25.0	50.0
6. Equivalent depth on watershed, inches	7.8	15.6
7. Equivalent depth on lake surface, inches	11.9	23.9
8. Annual rainfall on lake surface, inches	31.2	31.2
9. Annual inflow in depth, inches	0.0	0.0
10. Total supply in depth, inches	43.1	55.1
11. Annual evaporation in depth, inches	15.0	15.0
12. Available surplus, inches	28.1	40.0
13. Measured outflow, inches	36.7	.....
14. Ratio: Outflow / surplus	1.31	.....

(2) LAKE MICHIGAN.

1. Area of watershed, square miles	45,700	.....
2. Area of water surface, square miles	22,400	.....
3. Factor: Watershed / lake surface	2.040	.....
4. Annual rainfall on watershed, inches	33.6	.....
5. Average run off, percentage	25.0	50.0
6. Equivalent depth on watershed, inches	8.4	16.8
7. Equivalent depth on lake surface, inches	17.1	34.3
8. Annual rainfall on lake surface, inches	33.6	33.6
9. Annual inflow in depth, inches	0.0	0.0
10. Total supply in depth, inches	50.7	67.9
11. Annual evaporation in depth, inches	21.6	21.6
12. Available surplus, inches	29.1	46.3
13. Measured outflow. inches	....	.....
14. Ratio: Outflow / surplus	....	.....

(2)+(3) LAKE MICHIGAN PLUS HURON.

1. Area of watershed, square miles	97,800	.....
2. Area of water surface, square miles	45,600	.....
3. Factor: Watershed / lake surface	2.145	.....
4. Annual rainfall on watershed, inches	33.6	.....
5. Average run off, percentage	25.0	50.0
6. Equivalent depth on watershed, inches	8.4	16.8
7. Equivalent depth on lake surface	18.0	36.0
8. Annual rainfall on lake surface, inches	33.6	33.6
9. Annual inflow in depth, inches	18.75	27,9
10. Total supply in depth, inches	70.35	97.5
11. Annual evaporation in depth, inches	21.6	21.6
12. Available surplus, inches	48.75	75.9
13. Measured outflow, inches	67.02	.....
14. Ratio: Outflow / surplus	1.38	.....

(2)+(3)+(4) LAKE MICHIGAN PLUS HURON PLUS ST. CLAIR.

1. Area of watershed, square miles	104,190	.....
2. Area of water surface, square miles	46,095	.....
3. Factor: Watershed / lake surface	2.259	.....
4. Annual rainfall on watershed, inches	34.0	.....
5. Average run off, percentage	25.0	50.0
6. Equivalent depth on watershed, inches	8.5	17.0
7. Equivalent depth on lake surface, inches	19.20	38.3
8. Annual rainfall on lake surface, inches	34.0	34.0
9. Annual inflow in depth, inches	19.5	27.9
10. Total supply in depth, inches	72.7	100.2
11. Annual evaporation in depth, inches	21.7	21.7
12. Available surplus, inches	51.0	78.5
13. Measured outflow, inches	67.0	.....
14. Ratio: Outflow / surplus	1.31	.....

(5) LAKE ERIE.

1. Area of watershed, square miles	24,480	.....
2. Area of water surface, square miles	10,000	.....
3. Factor: Watershed / lake surface	2.448	.....
4. Annual rainfall on watershed, inches	37.2	.....
5. Average run off, percentage	25.0	50.0
6. Equivalent depth on watershed, inches	9.3	18.6
7. Equivalent depth on lake surface, inches	22.8	45.6
8. Annual rainfall on lake surface, inches	37.2	37.2
9. Annual inflow in depth, inches	235.1	406.0
10. Total supply in depth, inches	295.1	488.8
11. Annual evaporation in depth, inches	24.0	24.0
12. Available surplus, inches	271.1	464.4
13. Measured outflow, inches	339.6	.....
14. Ratio: Outflow / surplus	1.31	.....

(6) LAKE ONTARIO.

1. Area of watershed, square miles	25,530	.....
2. Area of water surface, square miles	7,450	.....
3. Factor: Watershed / lake surface	3.427	.....
4. Annual rainfall on watershed, inches	33.6	.....
5. Average run off, percentage	25.0	50.0
6. Equivalent depth on watershed, inches	8.4	16.8
7. Equivalent depth on lake surface, inches	29.2	58.4
8. Annual rainfall on lake surface, inches	33.6	33.6
9. Annual inflow in depth, inches	364.0	620.3
10. Total supply in depth, inches	426.8	712.3
11. Annual evaporation in depth, inches	24.0	24.0
12. Available surplus, inches	402.8	688.3
13. Measured outflow, inches	547.0	.....
14. Ratio: Outflow / surplus	1.392	.....

MOUNTAIN STATIONS IN AUSTRALIA.

The following extract from a letter addressed to the Chief of the Weather Bureau, by Clement L. Wragge, Government Meteorologist, Brisbane, Queensland, Australia, dated February 7, 1898, shows that mountain meteorology is not to be confined to the Northern Hemisphere and the great continents, but will be prosecuted wherever mountain peaks can be found. We also infer that the Australian stations on Mount Wellington and Mount Kosciusko represent a general attack upon the problem of upper currents in which the whole of Australia, and not merely any one district, is interested. Indeed, for that matter, the whole Northern Hemisphere is interested in what goes on in the upper regions of the Southern Hemisphere, and we wish every success to Mr. Wragge's enterprise and to all similar efforts:

I have much pleasure in informing you that, on the 9th of December last, I established an experimental meteorological observatory on Mount Kosciusko, 7,328 feet, the highest mountain in New South Wales; and by January 1, a similar station correlative thereto was also established near the sea level at Merimbula, in New South Wales. Simultaneous observations are taken at both stations every four hours, commencing at midnight; and also, as a special series, half-hourly, between 8 a. m. and noon, on the original Ben Nevis lines. Simultaneous readings are also taken at Sale, in Victoria, near the sea level, and also at a special station established by me in the city of Sydney. Simultaneous observations are further taken (with the exception of those at the half-hours) at Hobart, on the summit of Mount Wellington, and at the Half-way Station. I sincerely trust that the results will prove of value to meteorology.

The principal donors to the Kosciusko scheme are Mr. Barr-Smith, of Adelaide, and the Honorable G. H. Reid, premier of New South Wales, as representing the New South Wales Government.

I hope to be able to make arrangements for the continuation of the mountain station during the winter months, but am not, as yet, quite sure on that point. At any rate, the Kosciusko experiment will be repeated at the close of the coming winter. You will see full accounts by the various newspapers which you will receive in due course, and this letter must be taken as my official intimation.

TIN ROOFS AS LIGHTNING CONDUCTORS.

A recent letter from Dr. John W. Kales, of Franklinville, N. Y., describes a terrific thunderstorm at that place on May 19, on which occasion several persons within houses were

more or less affected. A boy reported a ball of lightning, or fire, passing down his limbs; his hand, in contact with an iron sink, was scorched, showing how large a proportion of the discharge passed through him to the city water main, although he was 200 feet distant from the central electric discharge.

The electrician of the Weather Bureau (Mr. J. H. Robinson) informs us that in all his experience a house with a tin roof was never injured by lightning; he considers that a house having a tin or metal roof, connected by one or more rain spouts to the ground, is a much safer protector against lightning than the ordinary lightning rod. The great surface of the roof allows the electric discharge to diffuse in all directions and diminishes the chance of fire or death.

The Editor would be glad to receive from each of his readers a statement as to the statistics of relative damage done when flashes strike houses or barns having shingle, slate, or tin roofs. His own impression is that buildings in cities, which are usually covered with tin, are quite as apt to suffer as buildings in the country covered with shingles, slates, or tiles, and that buildings without lightning rods suffer more than those of the same kind with lightning rods.

It has been satisfactorily shown that an object placed within a metallic inclosure is entirely unaffected by any electric current that passes through the metallic covering, as the latter conducts the electricity around it. On this principle, important buildings have been protected by a network of wires and rods. In so far as a tin roof more or less completely incloses a building it affords similar protection; but as a severe flash would probably melt the soldered joints, and even the sheet-iron itself, we think it would be cheaper to use lightning rods to protect the tin roof from destruction.

The German insurance companies distinguish between "cold strokes," that do not set fire to buildings, and "hot strokes," that do produce conflagrations. Is the difference due to the flash or to the object that it strikes, or is it simply a question of the ratio between the intensity of the electric discharge and the conducting power, or the resistance, of the object through which the electricity must pass in order to reach the ground?

TEMPERATURE OF LAKE WATER.

The temperature of the water in quiet lakes and ponds must, in general, be colder in the winter season than in the summer. Of course the colder, denser water will sink to the bottom as the autumn and winter advance.

If the surface temperatures go down to 39° F. the surface water must sink to the bottom, and the lowest water must come up on account of its buoyancy. The measurement of temperatures at various depths in a lake will show when this interchange of top and bottom water is about to take place, and is, therefore, a matter of importance to the engineers in charge of the water supply of large cities, as well as to those engaged in the business of cutting ice. Of course there can be no formation of ice at the surface of still water until after this vertical interchange has taken place, and the temperature of 39° prevails throughout the lower part of the pond. In rapidly running water the conditions are somewhat different.

The measurement of temperatures at any depth is easily accomplished by means of some form of electric thermometer. The "Thermophone" of Warren and Whipple is peculiarly adapted to this work. Measurements of this kind were made on July 1, 1896, in Clear Lake, Lepreau Township, southwestern New Brunswick, by Prof. W. F. Ganong, and are published in the Bulletin of the New Brunswick Natural History Society. This lake is about one-third of a mile long and one-sixth of a mile broad, and its maximum depth is 78 feet, which is very deep for so small a lake. The temperatures observed at 11 different points showed that the water was very uniformly stratified as to temperature and density, as might be expected from the fact that its outflow is very slight. The average result gives the accompanying table of temperatures and depths:

Depth.	Average temperature.	Depth.	Average temperature.	Depth.	Average temperature.
Feet.	°	*Feet.*	°	*Feet.*	°
3	65	30	47.6	57	43.0
6	65	33	46.2	60	42.6
9	65	36	45.0	63	42.5
12	65	39	44.3	66	42.5
15	64.7	42	44.1	69	42.5
18	63.9	45	43.6	72	42.5
21	59.2	48	43.5	75	....
24	54.7	51	43.0	78	....
27	50.7	54	43.0		

Although the last two depths were not measured, yet it is evident that they are not likely to have been less than 42.0°.

Mr. Ganong concludes that down to a depth of 12 feet the diurnal effect of solar heat is appreciable, and that the surface movements of the water, such as the waves due to the wind, help to distribute this heat uniformly; that below 18 feet the layers of water derive their temperatures by conduction from those above them.

Mr. Ganong also says that at depths below 30 feet the temperature is slightly higher at any given depth over shallower places than over deeper ones, indicating that the ground warms the water in contact with it, which is to be expected since it is a better conductor of heat; but this is a very slight matter, and, in general, the temperature depends on the depth from the surface and not on the height above the bottom.

As these observations were made on only one day in midsummer, they can give us no information as to the changes in temperature of the whole pond with the season, not even its changes with the hour of the day, although undoubtedly the measurements made occupied the greater part of the day. The temperature of the air at the surface of the lake in the morning was 71° F., or 6° higher than the temperature of the surface of the water.

METEOROLOGY OF THE SECOND WELLMANN EXPEDITION.

The first Wellmann expedition sought to reach the North Pole in 1894 by way of Spitzbergen. It left Tromsoe May 1, and reached Dane's Island May 7. After a long struggle near Spitzbergen, attaining latitude 80° 37′ N., it returned to Tromsoe, August 15. Mr. H. H. Alme, of the Meteorological Office at Christiania, Norway, accompanied the expedition as meteorologist and physicist, but Mr. Owen B. French, of the Coast and Geodetic Survey, Washington, was in charge of all the scientific work, and personally officiated as astronomer and geodesist. The meteorological records kept by Mr. Alme were reduced by him and forwarded to Washington through Professor Mohn, but so far as we know they have not yet been published. On account of the daily movements of the observer the principal value of such records is its use as a means to fill up the daily weather map for distant portions of the globe. Now that Mr. Wellmann has organized the second arctic expedition, via Franz Josef Land, the Weather Bureau has given Mr. E. B. Baldwin, observer, a furlough, in order that he may volunteer his services as meteorologist. Of course, the law providing for the Weather Bureau does not contemplate arctic exploration, or the pursuit of meteorology beyond the bounds of the United States, therefore, Mr. Baldwin must go without compensation from the Government.

The study of climatology is generally considered as an extremely local problem but the study of meteorology can never be so. The meteorologist must take in the whole atmosphere, horizontally and vertically, and our science is to

be congratulated that we have here one more volunteer who devotes himself, regardless of time and money, to the accumulation of the data needed for its advancement.

The Weather Bureau has, of course, assisted to the extent of its legal privileges by furnishing the expedition with apparatus, and it is hoped that Mr. Baldwin's enthusiasm will be rewarded, not only by a sight of the Polar Region, but by a fine collection of meteorological records.

NOTES FROM THE REPORTS OF THE CLIMATE AND CROP SECTIONS.

KENTUCKY.

Some excellent selections are given from Mr. Milton Whitney's article on climatology in a recent number of Science. The Editor has contemplated some remarks on this subject as he thinks that Professor Whitney's article ignores those features of the climate that affect animal life and human industry and considers only that narrower branch of the subject which might be called vegetable or agricultural climatology. The extracts published in the Kentucky report very discreetly avoid too narrow a definition of climatology. The development of plant life varies with the nature of the plant and the soil quite as much as it does with the climate; it would be impossible to agree as to what plant should be taken as the climatologic standard to which our methods should be adjusted so that the elements of climatology could be worked out by means of it. Climatologists have received with universal accord the ideas disseminated by Professor Hann, and the numerical elements of climatology, which are, perhaps, as many as thirty in number, have already been so widely accepted that it would introduce confusion if we give that word a meaning different from what is now recognized. It seems much wiser for those who are going into very detailed studies in botanical biology to use the term "botanic climatology," under which heading may be included many items relating to the soil that have nothing to do with other branches of climatology.

MARYLAND.

The report for April reproduces a leaflet issued by Prof. Wm. B. Clark, of the Maryland State Weather Service, in which he describes the work of the voluntary reporters in that State and the process of compiling the weekly crop bulletins that are issued before noon of each Tuesday during the growing season.

The work as briefly outlined above, has been continuous in this section since the establishment of the service in 1892. During that time the cooperating observers have increased in numbers and efficiency, and in nearly all cases the same observer has acted continuously since the first enlistment of his services, and his interest in the work has apparently advanced with the length of the record obtained. There are now 70 active voluntary stations in the section, and 100 crop correspondents report regularly during the season. The present status of the work is satisfactory in a general sense, but additional observers are needed in a few districts, and the number of crop correspondents must be increased before the entire territory can be said to be thoroughly represented. It is the desire and intention of the section director to make the Maryland and Delaware section of the Climate and Crop Service second to none in the country, and earnest efforts to that end will be vigorously carried on until a perfect service is firmly established.

MINNESOTA.

The extensive forestal interests of this State make it very important that the art of forestry as it is now understood in Europe, and as it has been so thoroughly exemplified in the writings of Dr. B. E. Fernow, should form a prominent subject in the matter of public education. No State containing extensive forests can afford to neglect this important subject. Attention is called to the fact that the State of New York is now the first on record to move in this important matter. For many years, Dr. Fernow, as Chief of the Division of Forestry in the Department of Agriculture, has urged that the Federal Government take action with regard to the national forest lands. Our Federal policy is liable to vacillate but New York State policy is steadily improving. Dr. Fernow is called to be chief of the college of forestry established at Cornell University by the recent act of the State Legislature "to promote education in forestry and to encourage and provide for the establishment of a college of forestry at Cornell University." Dr. Fernow will have two assistants in the university and the management of 30,000 acres in the Adirondack Forest Preserve, as an object lesson for his students. When men have been properly trained by Dr. Fernow we may hope that they will have the care of all the forests of the State. There can be no doubt but that the expenditure of $2 per acre will bring in a direct net income of $4 or $5 from these lands, and a much larger indirect one. It is not sufficient to merely set aside forests for preservation, we must actually care for them, otherwise they become useless as a source of income and liable to become destroyed altogether by fire.

Other States, such as Maine, New Hampshire, Virginia, the Carolinas, Pennsylvania, Georgia, Michigan, and Minnesota, may well follow the example of New York as to forests and a college of forestry.

NEW JERSEY.

The current report gives several references to the beautiful halo of April 4. This was observed between 8 and 9 p. m., by Prof. R. W. Prentiss, at Rutger's College, New Brunswick, N. J., and John H. Eadie, voluntary observer at Bayonne, N. J., whose reports are given in detail; the fact of its appearance at Bergen Point, Paterson, Boonton, Rancocas, and Camden may also be inferred from the list of dates of lunar halos. A "lunar corona" was reported at Summerville. These points lie in the northern and western half of New Jersey. The halo was also observed to be very brilliant throughout the whole length of New York City. Items regarding halos do not occur in the April report of the New England section, but there can be scarcely any doubt that from the region of Greater New York and the adjoining part of Connecticut, southwestward over northern New Jersey into Pennsylvania, there was during this evening a northeast wind carrying enough moisture to form a steadily increasing haze, which finally became a thick cloud of ice needles, followed by snow during the night. Before the haze was thick enough to entirely obscure the moonlight, and while the ice needles preserved their original delicate prismatic shapes, and while the moon was high in the heavens, conditions were favorable for the formation of lunar halos at stations that were so located that the moon's rays passed through this hazy cloud of ice prisms.

In answer to several letters the Editor will state, that notwithstanding the beautiful prismatic colors, observers should be careful not to apply the word "aurora" to such halos. The word "aurora" is specifically applicable only to the morning twilight, dawn, or daybreak, and to the aurora borealis, an electric discharge that often resembles the morning and evening twilights in some particulars, but need never be mistaken by a careful observer. The faint halo around the moon, the brilliant circle around the zenith, and the beautiful arch of rainbow colors within the latter circle, as described by several persons in New York City, were all due to the reflection and refraction of moonlight by ice crystals high in the air above the observer, forming incipient snowflakes and preparing for the snowstorm of the next morning. The circle about the zenith as a center, and passing horizontally through the moon is called the parhelic circle; it is due to moonlight reflected to the eye from the vertical sides of prisms that are descending to the earth, point foremost, or with their axes vertical. If the moon is about 30° in angular

elevation above the horizon, then the parhelic circle will appear to have an angular altitude of about 30°, and will rise and fall with the moon; that seen on April 4 was generally rather lower than this. When the moon was in the southeast a brilliant arch of spectrum colors, red within and blue without, appeared to surround it at a distance of 22° on the upper side of the parhelic circle, but nothing was seen below the parhelic circle except faint traces of the other half of this circle around the moon. Where this small circle intersected the parhelic circle the two bright spots called sun dogs appeared.

The whole halo was particularly well defined about 8 p. m. in a misty sky, and it was not seen at all at places far beyond the border of the cloud of fine ice needles.

Popular interest in this phenomenon led to the revival of ancient superstitions and old wives' fables on the part of those who persist in attributing a hidden meaning to every natural phenomenon; but to the common sense of the educated public such a halo simply means that the air is loaded with moisture preparatory to rain or snow. It would be highly creditable to the popular writers in the daily journals if they would persist in disseminating scientific, and opposing the mystic, interpretation of all such natural phenomena.

PENNSYLVANIA.

The April report contains a timely article by G. M. Powell on the importance of forest culture.

It is easily recognized that the growth of forests produces a different climate within the forest from that which existed on the open land before the forest grew up; but this is not what is ordinarily meant by the influence of forests upon climate. Similarly the destruction of a forest entirely alters the temperature of the air near the soil, and allows the free access of the wind to carry away the moisture that evaporates from the soil; but this, again, is not the influence of forests upon climate, but is simply the difference between the climate within the forest and the climate outside. In one paragraph Mr. Powell cautiously speaks of "the regulation, not increase of rainfall." In another paragraph he says, "forests influence rainfall much more quickly than is commonly supposed." As far as we can make out from the numerous investigations that have been made on this subject, there is no evidence whatever to show that the growth of a forest either increases, or decreases, or regulates, or influences the rainfall from the clouds. There are a few places on the globe where cloudy air driven against mountain sides loses a small fraction of its moisture by deposition of fog particles on leaves and branches, whence the moisture drips to the ground; the quantity of drip increases with the quantity of foliage, but as for rainfall proper, there is no reason to think that it is or can be appreciably affected by the presence of forests.

VIRGINIA.

The April number contains an interesting extract from the Richmond Dispatch of December 27 in which some unknown author gives a very graphic picture of the remarkable results already attained and still further to be anticipated from the electrical battery recently constructed for the physical laboratory at Harvard College. The author's enthusiasm is certainly natural, and yet a conservative mind would, perhaps, not express himself so strongly. Prof. Edwin H. Hall, who is the first assistant in that laboratory, under date of May 31 says:

> Professor Trowbridge has had constructed at our laboratory a storage battery of 10,000 small cells, by means of which he can get directly a voltage of about 20,000. By connecting this battery with a large number of condensers in multiple, then connecting the condensers after they are charged, in series, he gets a voltage which runs into the hundreds of thousands, producing a spark about 6¼ feet long in air of ordinary atmospheric pressure. I believe that his estimate of the voltage required to produce a very long spark is greater than the estimate of previous experimentors. Of course great things may be discovered with such apparatus, but whether the predictions of the article you send me will be justified remains to be seen.

RECENT EARTHQUAKES.

Prof. T. Scherer, of the College of St. Martial, Port au Prince, Hayti, communicated an account of the earthquake at that place on December 29, 1897, the publication of which was unfortunately overlooked. It was as follows:

> On December 29, at 6 hours 32 minutes and 43 seconds a. m., a severe earthquake was experienced at Port au Prince, lasting one minute and thirty-one seconds. The following are the conclusions to be drawn from the curves traced by the Cecchi seismograph at the meteorological observatory of the College of St. Martial.
>
> The entire phenomenon consisted of five consecutive shocks, the total duration of which was forty-eight seconds, and of a series of feeble movements very perceptible to an attentive observer. The first shock lasted eight seconds; it began from east-northeast and ended from west-southwest. The vertical component was quite strong at about the fifth second. The movement immediately began again, with more force in the horizontal direction and less in the vertical; this lasted eleven seconds, and the direction from which it came was more toward the east. The third shock lasted three seconds, and was characterized by a very regular oscillatory movement. The fifth shock was the strongest, lasted ten seconds, began from the northeast, and died away in the southwest with a vertical component that was scarcely appreciable. All the other movements (after the forty-eighth second) were feeble, with the same horizontal direction. During all this time the seismic pendulum described eclipses in the sand, whose major axes varied from northeast through the south to southwest. The Bertelli microseismometer was for a long time agitated, and finally maintained a north-south direction.
>
> The same earthquake, and with the same features, was felt throughout the neighborhood of Port au Prince. It seems to have also been very violent in the interior of the island of Dominica.

Under date of May 12, Prof. T. Scherer writes further:

> It seems to me that there is an error of date in your account of the earthquake attributed to the 15th of December, 1897, at Santiago, in the Republic of San Domingo. (See the December number of the MONTHLY WEATHER REVIEW, page 542.) I have a report of this earthquake by Dr. Llenas, Minister Plenipotentiary from the Republic of San Domingo to Hayti, who was at Santiago at the time. He gave me a detailed account of the earthquake that occurred at about 6:30 a. m., December 29. The details are very nearly the same as given in the MONTHLY WEATHER REVIEW, but no earthquake took place before the 29th of December. The earthquake at Santiago accords very closely with that at Port au Prince, a report of which I sent you with my meteorological record for December.

The Editor regrets the delay in publishing Professor Scherer's report on the earthquake of December 29. He is unable to explain the apparent error in the MONTHLY WEATHER REVIEW, but it is altogether likely that the record for December 15, on page 542, should be credited to December 29. We may, therefore, conclude that the earthquake on the morning of that date was felt most severely throughout San Domingo, but very appreciably also at Grand Turk and Port au Prince.

Prof. E. W. Morley, of Cleveland, Ohio, reports that there was no seismic disturbance there during the month of April. There was also none recorded by the Marvin seismograph at the Weather Bureau, Washington, D. C. The following are reported elsewhere:

April 14.—San Francisco, slight; first at 10:53, and second at 11:07. Eureka, two shocks, 10:50 p. m. and 11:10 p. m.; the second was the heaviest for many years. Sacramento, nothing felt or heard. Oakland, two slight shocks at 11:10. Light shocks were noticed as far south as San Jose and up to Port Costa. Mendocino, first at 10:45, then slight vibrations until the most severe shock, at 11:10 p. m., followed by light shocks throughout the night. Considerable damage done throughout Mendocino County. Point Arena, first shock 10:54; severe quake at 11:09 p. m., continuous shakes until 9 a. m. the next day. Napa, slight shock at about 11:30. Christine, 10:50 p. m., violent, followed by many light shocks for three days. The earth is said to have trembled more or less during the whole of the subsequent week throughout

Mendocino County. The interior towns suffered very little. the severest shocks were at Albion, Comptche, and Christine.

April 25.—Severe at Albion and Mendocino, Prairie Camp, Greenwood, Noyo, and Fort Bragg.

LIGHTNING ON THE KITE WIRE.

Ever since the historical experiments of Franklin in Philadelphia, and of DeRomas in France, it has been a question to what extent it might be dangerous for the meteorologist to handle the wet cord or the modern iron or steel wire used in flying kites during thunderstorms. The early observers in Europe recommended a distinct safety connection or grounding of the wire a short distance in front of the observer. Rather severe shocks have been received in the ordinary course of kite flying, but so far as the record shows nothing really dangerous to human life. It was from the beginning evident that a dry cord could not convey a dangerous charge of electricity from the sky to the earth. We now know that the resistance of such a cord is so great that it would be burned or destroyed by small discharges long before a lightning flash occurs. It is only in proportion as the line becomes a more perfect conductor that it can have any appreciable influence in determining the location of the path of the discharge. When Professor Richman was struck dead in his laboratory by a discharge of lightning, at St. Petersburg, he was using outside of the building a much larger conductor than would ever be associated with a kite. The strongest shocks hitherto observed, as received from kite lines, were those observed by DeRomas when he used a strong linen cord around which a small copper wire was wound, but these did him no harm.

These ancient experiments are brought to mind by the recent experience of some of the aerial observers for the Weather Bureau, whose reports have been kindly placed at the Editor's disposal by Professor Marvin.

Mr. E. E. Spencer, aerial observer, reports that at his station (Fort Thomas, near Cincinnati, Ohio), at 6 a. m., May 16, the kite line wire was completely destroyed by a heavy electric discharge from the air. The kite and meteorological register were landed safely about 20 miles distant and secured in good condition. About 12,000 feet of wire were out and 500 still remained on the reel, but all was burned or spoiled. Mr. Spencer says:

The kite was started shortly after 4 a. m., seventy-fifth meridian time, and after the first few hundred feet of line had been payed out it struck a good current of air, and had taken out 5,000 feet of wire at 5 a. m. and 10,000 feet at 6 a. m. Observations were taken at both these hours. The kite was flying so steadily and at a very nice angle that I let out 12,160 feet, and was going to take an observation at 6:15 a. m. I had but just left the reel for this purpose when a very heavy electric current literally burned the wire up, particles of the melted wire adhering to the reel. A stream of fire seemed to run from the kite to the reel, completely burning the entire line. To me the most singular feature about it is the fact that at the time the wire was burned the kite was flying in a comparatively clear sky to the northeast, although a bank of clouds was visible in the west and a very light shower fell a few minutes afterwards, continuing but a couple of minutes. No thunder was heard here. We watched the kite drift rapidly away to the northeast until it was lost to view away across the river, and then we went for it. The kite was tagged, with directions for notifying me if found. I notified all postmasters and school-teachers within 20 miles and put similar notices in the newspapers. While I congratulate myself that I did not have hold of the reel when the wire parted, yet I may say that I had examined the switch less than two minutes before, and there was apparently very little electricity going through the wire, and we were congratulating ourselves that we were going to have a successful ascension after five days of hard work.

At Lansing, Mich., Mr. Charles A. Hyle, aerial observer, reports that—

On May 18 the Weather Bureau kite was launched at 7:47 a. m.; by 8:01 7,500 feet of wire had been reeled out; at 8:20 a. m. distant thunder was heard in the west, and the wire began to be reeled in; rain began to fall at 8:52; at 9 a. m. a powerful bolt of lightning came down the wire, which was quickly consumed. From my position at the reel, where I had command of both brakes, I saw a shower of sparks, accompanied by a sharp report, and then a rope of smoke, stretching from the reel to the kite. In holding the wooden levers, I had released the iron guiding-bar, which action I believe saved me from a heavy shock; the slight one that I did receive stunned me for an instant. Many citizens who were watching the kite report that a column of fire about a foot in diameter seemed to come down the wire; but those who were at a distance claim that the fire seemed to rise to the kite. All are agreed that the wire seemed to be on fire from one end to the other; immediately afterwards a rope of smoke appeared throughout the length of the wire. As many as thirteen places were found where the discharge had jumped from the wire to the brake strap and penetrated the reel, one of them forming a weld between the brake strap and the reel. The kite was found about 4 miles north of the reel, only two sticks were broken and will be repaired in a short time. The safety wire was fused, as also several of the guy wires. When the damaged wire that remained on the reel was removed, it was found that 4,420 feet were serviceable, and 4,015 feet had been destroyed by the discharge.

Under date of May 28, Mr. Paul DeGraw, aerial observer at Springfield, Ills., says:

On the 27th, at 4 p. m., when 6,000 feet of kite line were out, a storm was seen approaching from the southwest. The work of reeling in the kite was begun immediately, and at 4:30 p. m., when the rain began, the dial reading was 503. A very few moments later the kite was apparently struck by lightning, which destroyed the wire between the kite and a point about 3 feet from the reel, without harming the reel or the wire wound upon it. The kite was found about 1¼ mile north of the station, slightly damaged by the lightning. The amount of wire lost was 2,297 feet.

In a report from Mr. G. Harold Noyes, aerial observer at Topeka, Kans., dated May 31, he says:

A kite ascension was made at 9:12 this morning and at 10:47 an altitude of 5,047 feet was observed. In pursuance of circular of May 26, from Chief of Instrument Division in regard to electrical discharge in the thunderstorm season, I watched the amount and intensity of the electricity coming down the line, and at 11:50 I noticed it to be increasing. My assistant and I commenced to reel in the 8,000 feet of line that were then out, but it rained soon after we commenced reeling. We had just reeled in a little more than 3,000 feet, when without warning a bolt of electricity came down the wire, burning and breaking it, setting loose the kite. The concussion was so great that people standing 1,000 feet away thought we were shooting. We were reeling the kite in the usual manner, each with a hand on the iron steering handle of the reel-box; the discharge stunned us measurably. * * * It was some moments before we could realize all that had happened. * * * The kite which had an elevation of some 3,000 feet had fallen nearly out of sight before we recovered our self-possession. The wire was hot when I picked it up and was burned brittle and black. The kite fell to the ground breaking only one stick; it is burned a little at one corner which is evidently the point where the discharge entered. The self-registering apparatus is uninjured. The breaking of the wire was not caused by a continuous flow of electricity, but apparently by a single discharge. The rest of the wire on the reel is, I think, still good.

We do not know that any provision can be made for the prevention of the burning of the kite line when once a powerful discharge from the sky falls upon it. The line is too delicate to stand such discharges as must occur in the neighborhood of thunderstorms. It would destroy the efficiency of the kite to make the wire much larger and, for the present, of course, it will be best not to expose the kite line to the chances of destruction.

Undoubtedly the discharges that destroy the wire are but preliminary ones, indicating the proximity of a still more disturbed condition, with severe lightning and thunder. If electrical apparatus and expert observers were sufficiently numerous we should long since have been able to determine the breadth of the zone about any storm-center within which it is useless to attempt to fly kites with fine steel wire. No such destructive discharges are recorded in ordinary fair weather, but there is always some electricity on the wire and, of course, a connection between the reel and the ground is always at hand to carry off the small discharges that annoy the operator.

It will be observed that in the four preceding cases thunderstorms were reported from stations within 100 or 200 miles

of the kite at the regular 8 a. m. telegraphic report. The kites were being flown in regions within which rain had fallen during the preceding twelve hours, where cloudy weather still prevailed, and where the surface winds were southerly, midway between regions of high and low pressure.

Afternoon thunderstorms are often called heat thunderstorms, because their occurrence is evidently dependent directly upon local temperatures. The thunderstorms that injured our kites on the mornings of May 16, 18, 27, and 31 all occurred as a part of wide-spread systems of thunderstorms attending general areas of low pressure. These have all been classed as "cyclonic" thunderstorms. These areas pass over the country at about the same rate as the areas of low pressure, but the thunderstorm region reaches out to a point about midway between the areas of low pressure and high pressure. By studying the weather map of the previous evening one may almost certainly foresee whether it will be safe to make the kite ascension early the next morning. It is evident that the successful use of the kite in the central portion of the Mississippi watershed, which is now covered by our sixteen kite stations, will depend upon the distribution of the tracks of the areas of low pressure.

The study of atmospheric electricity was prosecuted in former years until, under the advice of Prof. T. C. Mendenhall, it was decided that the electrometer and water-dropping collector was not likely to be of any practical value in weather forecasting. The study was, therefore, laid aside until some other reason should appear for the further prosecution of the subject. It is generally believed that the electrification of the air is not a matter of great importance in the study of the mechanics of the atmosphere. The electrification seems to be one of the minor results of the formation of fog, haze, cloud, and rain. Thus, Elster and Geitel, in their review of recent investigations into the subject of atmospheric electricity (see Weather Bureau Bulletin 11, Part 2, p. 514), say:

> Since regions of precipitation show the greatest variation of potential the question arises whether such regions may be detected at a great distance by the behavior of the electrical apparatus; that is, whether it will not be possible to employ electrical measurements for forecasting the weather. This idea was tested in an extensive series of observations by Mendenhall. A negative result was obtained. One must, therefore, consider the electrical developments attending upon precipitation as being essentially local and these may be excluded in the investigation of normal electricity. * * * One can either consider the whole earth as a sphere with a negative charge of electricity acting upon the atmosphere and the regions above it by induction, which is Exner's method of treatment, or he may, like Lord Kelvin, consider the atmosphere as the dielectric of a condenser of which the lower side, or the earth surface, is negative, and the upper side, or upper layer of the atmosphere, is positive.

The electric condition at the surface of the earth is subject to an annual and a diurnal variation, but still more to a nonperiodic variation known as the electric storm. Exner shows the great need of measurement of potential fall at great heights above the earth's surface. Possibly the kite will offer an interesting method of attaining this desideratum. Efforts in this direction have been made by Mr. A. G. McAdie. If the electricity originates in the earth, then it must be considered as being dissipated by discharge into the atmosphere, and the daily and annual variations of the normal terrestrial charge should be accompanied by an opposite daily and annual variation in the normal atmospheric charge. The electrical phenomena attending rain or other form of precipitation must be considered as disturbances of the normal electrical field.

The origin of the electrification observed on the kite wire, and the manner of transfer of electricity from the air to the wire, and *vice versa*, are but little understood. Professor Marvin calls attention to the differences observed on different occasions, as follows: Sometimes everything goes to show that the wire is being continuously electrified, little by little, just as if every particle of air impinging upon the wire communicated to it, or carried away, a minute electrical charge. This seems to be the only circumstance of electrification in the winter time. In the summer season, however, in addition to the above phenomenon, he finds that sudden, often very considerable, impulsive rushes of electricity pass over the wire without the slightest apparent cause and in an infrequent and most irregular manner. All such discharges are strictly momentary, and, when one has been observed to pass, others are sure to follow, although several seconds, or even minutes, may intervene.

Professor Marvin says his kite wire, in these cases, is the receiving instrument in an immense, wireless, telegraphic system. Nature is producing signals along his kite wire, which mean that flashes of lightning are passing at some far distant point; only rarely are these perceptible to the ordinary senses. All currents of the above described character may be called inductive discharges. It seems probable in some cases that such currents may be strong enough to fuse the wire. This appears to have been the case at Cincinnati. Finally, the wire may be charged with electricity by being actually struck with lightning; that is, the wire forms part of the path chosen by the bolt in passing between the clouds and the earth. There thus appear to be at least three different conditions leading to the electrification of the kite line.

So long as the wire is grounded the variations of potential at the earth and the upper end of the wire will always be sufficient to produce some slight currents; the wind blowing past the kite and wire tends to reduce the latter to the same electric potential as that of the air.

The Editor has often experienced the tingling sensations and the violent nervous shock produced when a natural bolt of lightning has struck within a hundred feet of him and he regards the discharges precipitated on to these Weather Bureau kite wires as miniature premature bolts, probably too feeble to do any serious damage. The discharges that are brought down the kite line are to be considered as timely warnings. They may destroy the kite wire, but they tend to save the observer. They act like the patent fuses that melt before the boiler explodes or the electric fuses that protect the dynamos, and are as precious to the observer in a thunderstorm as the safety wire in the bridle of the kite is important to it in a windstorm.

The kite wire used by the Weather Bureau is of the highest grade of steel, 0.028 inch in diameter, having a tensile strength of about 210 pounds, or at the rate of about 350,000 pounds to the square inch.

Professor Marvin has employed the electric light current from the small dynamo of the Weather Bureau in testing the carrying power of the steel kite wire, and finds that a continuous current of about 15 amperes at about 100 volts is required to heat the wire to full red incandescence and maintain it at that temperature. Nearly a minute of time was consumed in reaching the maximum heat. This is doubtless the minimum strength of a destructive current, inasmuch as the wire must be torn assunder by the pull of the kite by the time it reaches a full red heat under a more or less steady current. Just how much greater current would be carried by the line when instantly fused by a momentary current in the full ventilation of the wind is difficult to estimate, but it is undoubtedly much higher than the current employed in the test.

At a red heat the resistance of the wire is shown, by the rough tests made, to be about 0.7 ohm per foot, but this is nearly five times greater than the resistance when cold. From these data we are led to deduce that the electrical discharge which fused the 12,000 feet of line near Cincinnati had a potential of at least 130,000 volts.

Of course we are very sorry to lose a continuous meteorological record within a thunder cloud, just because the light-

ning persists in burning up our kite line; but the record must be obtained; the progress of meteorology must not be thwarted; a simple method for overcoming the difficulty must be found.

CORRIGENDA.

February REVIEW, 1898, page 61, table for Honolulu, for "1897" read "1898"; maximum and minimum temperatures for February 8, read "79" and "63"; all those given for February 8–27 to be dropped one line, and belong to February 9–28.

REVIEW for March, 1898, page 103, Mexican table, for "Tuxtla (Gutierrez)" read "Tuxtla, Gutierrez (Chiapas)." Page 107, line 24 from bottom, second column, for "1897" read "1898;" line 3 from bottom, for "Fig. 8" read "Fig. 7;" line 2 from bottom, for "afternoon" read "morning." Page 108, column 1, line 18, for "Charts VII and VIII" read "Charts X and XI."

METEOROLOGICAL TABLES AND CHARTS.

By A. J. HENRY, Chief of Division of Records and Meteorological Data.

Table I gives, for about 130 Weather Bureau stations making two observations daily and for about 20 others making only one observation, the data ordinarily needed for climatological studies, viz, the monthly mean pressure, the monthly means and extremes of temperature, the average conditions as to moisture, cloudiness, movement of the wind, and the departures from normals in the case of pressure, temperature, and precipitation, the total depth of snowfall, and the mean wet-bulb temperatures. The altitudes of the instruments above ground are also given.

Table II gives, for about 2,700 stations occupied by voluntary observers, the highest maximum and the lowest minimum temperatures, the mean temperature deduced from the average of all the daily maxima and minima, or other readings, as indicated by the numeral following the name of the station; the total monthly precipitation, and the total depth in inches of any snow that may have fallen. When the spaces in the snow column are left blank it indicates that no snow has fallen, but when it is possible that there may have been snow of which no record has been made, that fact is indicated by leaders, thus (....).

Table III gives, for about 30 stations furnished by the Canadian Meteorological Service, Prof. R. F. Stupart, director, the means of pressure and temperature, total precipitation and depth of snowfall, and the respective departures from normal values, except in the case of snowfall.

Table IV gives, for 26 stations selected out of 113 that maintain continuous records, the mean hourly temperatures deduced from the Richard thermographs described and figured in the Report of the Chief of the Weather Bureau, 1891–92, p. 29.

Table V gives, for 26 stations selected out of 104 that maintain continuous records, the mean hourly pressures as automatically registered by Richard barographs, except for Washington, D. C., where Foreman's barograph is in use. Both instruments are described in the Report of the Chief of the Weather Bureau, 1891–92, pp. 26 and 30.

Table VI gives, for about 130 stations, the arithmetical means of the hourly movements of the wind ending with the respective hours, as registered automatically by the Robinson anemometer, in conjunction with an electrical recording mechanism, described and illustrated in the Report of the Chief of the Weather Bureau, 1891–92, p. 19.

Table VII gives, for all stations that make observations at 8 a. m. and 8 p. m., the four component directions and the resultant directions based on these two observations only and without considering the velocity of the wind. The total movement for the whole month, as read from the dial of the Robinson anemometer, is given for each station in Table I. By adding the four components for the stations comprised in any geographical division the average resultant direction for that division can be obtained.

Table VIII gives the total number of stations in each State from which meteorological reports of any kind have been received, and the number of such stations reporting thunderstorms (T) and auroras (A) on each day of the current month.

Table IX gives, for about 70 stations, the average hourly sunshine (in percentages) as derived from the automatic records made by two essentially different types of instruments, designated, respectively, the thermometric recorder and the photographic recorder. The kind of instrument used at each station is indicated in the table by the letter T or P in the column following the name of the station.

Table X gives a record of rains whose intensity at some period of the storm's continuance equaled or exceeded the following rates:

Duration, minutes..	5	10	15	20	25	30	35	40	45	50	60	80	100	120
Rates pr. hr. (ins.)..	3.00	1.80	1.40	1.20	1.08	1.00	0.94	0.90	0.86	0.84	0.75	0.60	0.54	0.50

In the northern part of the United States, especially in the colder months of the year, rains of the intensities shown in the above table seldom occur. In all cases where no storm of sufficient intensity to entitle it to a place in the full table has occurred, the greatest rainfall of any single storm has been given, also the greatest hourly fall during that storm.

Table XI gives the record of excessive precipitation at all stations from which reports are received.

NOTES EXPLANATORY OF THE CHARTS.

Chart I.—Tracks of centers of high pressure. The roman letters show number and order of centers of high areas. The figures within the circles show the days of the month; the letters *a* and *p* indicate, respectively, the 8 a. m. and 8 p. m., seventy-fifth meridian time, observations. The queries (?) on the tracks show that the centers could not be satisfactorily located. Within each circle is given the highest barometric reading reported near the center. A blank indicates that no reports were available. A wavy line indicates the axis of a ridge of high pressure.

Chart II.—Tracks of centers of low pressure. The roman letters show number and order of centers of low areas. The figures within the circles show the days of the month; the letters *a* and *p* indicate, respectively, the 8 a. m. and 8 p. m., seventy-fifth meridian time, observations. The queries (?) on the tracks show that the centers could not be satisfactorily located. Within each circle is given the lowest barometric reading reported near the center. A blank indicates that no reports were available. A wavy line indicates the axis of a trough or long oval area of low pressure.

Chart III.—Total precipitation. The scale of shades showing the depth of rainfall is given on the chart itself. For isolated stations the rainfall is given in inches and tenths, when appreciable; otherwise, a "trace" is indicated by a capital T, and no rain at all, by 0.0.

Chart IV.—Sea-level isobars and isotherms, and resultant winds. The wind directions on this Chart are the computed

resultants of observations at 8 a. m. and 8 p. m., daily; the resultant duration is shown by figures attached to each arrow. The temperatures are the means of daily maxima and minima and are reduced to sea level. The pressures are the means of 8 a. m. and 8 p. m. observations, daily, and are reduced to sea level and to standard gravity. The reduction for 30 inches of the mercurial barometer, as formerly shown by the marginal figures for each degree of latitude, has already been applied.

Chart V.—Hydrographs for seven principal rivers of the United States.

Chart VI.—Surface temperatures; maximum, minimum, and mean. Lines of equal monthly mean temperature in red; lines of equal maximum temperatures (broken) in black; and lines of equal minimum temperature (dotted) also in black.

Chart VII.—Percentage of sunshine. The average cloudiness at each Weather Bureau station is determined by numerous personal observations during the day. The difference between the observed cloudiness and 100, it is assumed, represents the percentage of sunshine, and the values thus obtained have been used in preparing Chart VII.

Chart VIII.—The total snowfall. This is based on the reports from all available observers and shows the depth of the snowfall during the month in inches. In general, the depth is shown by lines and areas of equal snowfall, but in some cases figures are also given for special localities.

TABLE I.—*Climatological data for Weather Bureau Stations, April, 1898.*

Stations.	Elevation of instruments. Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Pressure, in inches. Mean actual, 8 a.m. and 8 p.m. ÷ 2.	Mean reduced.	Departure from normal.	Temperature of the air, in degrees Fahrenheit. Mean max. and min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches. Total.	Departure from normal.	Days with .01, or more.	Wind. Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Direction.	Date.	Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
New England.							42.3	-0.9										77	4.80	+1.5										6.4	
Eastport	76	69	74	29.80	29.89	.00	37.9	-0.7	62	17	44	15	4	32	25	35	32	81	3.80	+0.8	15	9,078	w.	52	e.	24	7	8	15	6.8	14.8
Portland, Me	103	81	89	29.80	29.91	-.01	41.2	-1.8	70	17	48	17	4	34	33	37	32	75	4.33	+1.3	12	6,227	ne.	29	ne.	28	7	9	14	6.4	10.0
Northfield	872	15	65	29.01	29.97	+.01	38.8	-0.5	67	13	49	6	5	28	39	35	30	73	2.74	+0.6	16	6,742	n.	35	nw.	18	5	13	12	6.3	2.7
Boston	125	115	181	29.80	29.94	+.01	43.8	-1.3	72	17	50	23	4	37	24	39	33	72	6.39	+3.0	17	9,262	ne.	42	ne.	28	7	10	13	6.5	2.2
Nantucket	14	43	54	29.90	29.92	-.04	42.4	-0.7	60	17	47	25	4	38	20	40	37	83	2.97	-0.6	18	10,923	ne.	48	ne.	28	6	8	16	6.7	T.
Woods Hole	22	51	57	....	....	....	42.2	-1.0	60	17	47	26	4	38	17	....	....	....	5.83	+1.8	17	11,478	n.	48	s.	24	9	5	16	6.3	3.5
Vineyard Haven	....	20	....	....	....	....	45.2	-1.2	66	17	52	27	4	39	21	....	....	....	6.69	+3.7	17	....	ne.	....	....	....	8	6	16	....	0.5
Block Island	27	39	48	29.91	29.94	-.01	43.0	-0.4	63	18	48	26	4	38	21	40	37	83	5.66	+2.2	17	13,870	ne.	72	ne.	28	8	13	9	5.9	5.1
Narragansett Pier	....	10	....	....	....	....	43.2	-1.0	66	30	50	20	4	36	28	....	....	....	5.13	+1.5	12	....	ne.	....	....	....	13	2	15	....	3.0
New Haven	107	118	140	29.83	29.95	-.02	45.4	-0.7	70	17	53	23	4	38	24	41	36	72	4.43	+0.9	13	8,685	ne.	40	ne.	28	7	11	12	6.0	2.0
Mid. Atlan. States.							49.2	-1.5										65	3.48	+0.2										6.0	
Albany	97	84	113	29.87	29.98	+.02	45.5	-0.5	73	17	54	20	6	37	33	40	33	67	2.63	+0.1	15	5,922	n.	29	w.	21	8	7	15	6.7	1.2
Binghamton	875	79	90	....	....	....	41.8	-3.7	70	17	50	17	3	33	36	....	....	....	2.79	+0.5	15	5,490	ne.	27	w.	20	6	11	13	6.5	1.3
New York	314	298	326	29.61	29.96	-.02	46.8	-1.3	74	17	54	25	6	40	25	40	33	65	3.23	-0.2	12	10,188	nw.	38	n.	5	4	14	12	6.6	2.6
Harrisburg	377	94	104	29.59	30.01	+.01	48.6	-1.5	74	17	56	22	6	41	24	41	32	57	1.95	-1.5	14	6,643	w.	36	w.	21	6	12	12	6.6	2.3
Philadelphia	117	168	184	29.85	29.97	-.02	49.5	-1.0	78	17	58	25	6	41	24	43	35	62	2.93	-0.1	14	8,840	nw.	36	ne.	28	6	8	16	6.8	3.1
Atlantic City	52	68	76	29.91	29.97	.00	46.9	+0.1	77	17	54	24	6	40	29	44	41	80	2.67	-0.6	13	10,389	nw.	48	ne.	28	4	16	10	6.3	T.
Cape May	24	52	70	29.96	29.98	....	48.2	0.0	73	17	53	31	6	44	21	....	....	....	4.81	+1.6	13	10,369	nw.	40	ne.	28	9	9	12	5.4	T.
Baltimore	123	68	82	29.85	29.98	-.02	51.2	-1.9	81	17	60	26	6	43	29	44	36	59	1.84	-1.6	12	4,839	w.	25	e.	19	7	14	9	5.7	0.1
Washington	112	59	76	29.88	30.00	+.01	50.9	-2.1	83	17	60	26	6	42	36	44	37	62	2.36	-1.0	14	6,406	nw.	34	nw.	2	11	8	11	5.5	1.0
Cape Henry	....	5	34	....	....	....	53.8	-0.8	86	1.	62	33	•	46	34	....	....	....	6.90	+2.4	11	....	s.	....	....	....	9	12	9	....	
Lynchburg	685	83	88	29.29	30.03	+.03	52.9	-3.0	86	17	63	26	6	43	39	45	36	57	2.94	-0.4	10	4,044	nw.	28	ne.	27	11	8	11	5.1	T.
Norfolk	57	88	93	29.94	30.00	.00	54.2	-2.0	86	18	62	31	6	46	31	48	44	74	6.09	+2.6	11	7,593	nw.	35	nw.	20	13	4	13	5.5	
Richmond	144	98	105	....	....	....	53.8	....	86	18	63	28	6	44	36	....	....	....	4.83	....	12	5,869	w.	35	n.	27	11	9	10	5.3	2.0
S. Atlantic States.							59.3	-2.7										68	3.38	0.0										4.2	
Charlotte	773	68	76	29.20	30.02	+.01	55.7	-4.0	82	18	65	30	6	46	28	47	38	59	2.71	-0.8	10	5,497	s.	37	s.	23	11	13	6	4.4	
Hatteras	11	17	36	29.99	30.00	.00	57.0	-0.2	73	23	62	38	•	52	24	53	50	82	4.39	-0.3	8	11,584	n.	76	n.	28	13	11	6	4.1	
Kittyhawk	9	12	30	....	....	....	55.5	-0.3	84	18	64	29	7	48	27	....	....	....	4.00	-0.4	8	12,019	....	....	....	....	12	10	8	5.3	
Raleigh	375	93	101	29.64	30.04	+.03	55.8	-3.0	86	18	66	30	6	46	33	47	40	62	3.05	+0.5	11	5,418	nw.	36	n.	27	11	10	9	5.0	
Wilmington	78	82	90	29.95	30.04	+.03	58.5	-3.0	81	17	68	35	7	49	28	52	47	72	2.40	-0.6	6	7,059	sw.	48	ne.	27	15	11	4	3.4	
Charleston	48	14	92	30.03	30.08	+.05	63.0	-1.6	82	20	71	43	7	55	23	54	47	63	2.48	-1.1	8	8,314	sw.	42	nw.	27	16	11	3	3.7	
Columbia	....	5	....	....	....	....	58.0	-5.0	85	18	70	33	7	46	37	....	....	....	4.90	+2.1	9	....	ne.	....	....	....	11	9	10	....	
Augusta	180	89	103	29.86	30.05	+.05	58.9	-5.3	84	18	70	35	7	47	36	52	46	67	4.96	+1.6	10	4,800	nw.	35	sw.	14	15	8	7	4.0	
Savannah	82	63	89	29.98	30.07	+.02	63.6	-2.5	86	19	74	42	28	54	28	54	48	66	2.46	-1.0	7	6,896	s.	42	nw	26	17	5	8	4.0	
Jacksonville	43	69	84	30.03	30.08	+.04	66.7	-2.2	86	24	77	42	8	57	31	59	56	75	2.45	-0.4	7	5,506	sw.	36	sw.	5	16	12	2	3.7	
Florida Peninsula.							72.0	-1.0										70	0.89	-0.9										3.0	
Jupiter	28	13	30	30.05	30.08	+.04	71.8	-0.2	87	5	79	51	28	65	23	64	60	70	1.90	-0.5	6	7,980	s.	30	se.	24	18	11	1	3.4	
Key West	22	43	50	30.08	30.10	+.06	75.4	-0.7	84	24	79	65	28	72	14	68	64	71	0.61	-0.6	2	8,271	se.	28	ne.	8	20	9	1	3.2	
Tampa	36	60	67	30.05	30.09	+.04	68.9	-2.2	88	22	78	48	8	59	30	60	56	69	0.16	-1.7	5	5,892	w.	30	w.	14	21	6	3	2.5	
East Gulf States.							62.3	-4.2										67	2.93	-1.5										3.9	
Atlanta	1,131	92	126	28.87	30.08	+.04	56.5	-5.1	80	30	65	32	6	48	26	48	39	58	5.15	+1.4	10	7,263	nw.	32	nw.	15	11	8	11	5.1	T.
Pensacola	56	78	90	30.04	30.10	+.06	64.0	-3.7	80	20	72	40	6	56	26	57	52	68	1.68	-1.8	6	7,479	sw.	38	nw.	5	17	8	5	3.5	
Mobile	57	88	96	30.04	30.10	+.07	62.5	-4.4	82	23	71	40	7	54	28	55	50	69	2.61	-2.1	8	5,480	n.	31	n.	19	16	10	4	4.0	
Montgomery	221	100	112	29.85	30.09	+.05	61.0	-4.4	86	30	72	34	6	50	32	53	46	62	4.31	-0.5	6	5,134	n.	36	sw.	23	19	5	6	3.5	
Vicksburg	247	65	73	29.81	30.08	+.07	62.0	-3.8	83	30	71	36	6	53	26	56	53	78	2.83	-3.0	9	5,579	se.	36	nw.	22	17	8	5	3.6	
New Orleans	54	112	120	30.05	30.11	+.10	65.1	-3.9	82	23	73	43	7	57	23	57	52	67	2.80	-2.4	6	7,203	se.	32	nw.	14	16	10	4	3.5	
Port Eads	....	27	....	....	....	....	65.0	-4.4	76	•	71	49	•	59	17	....	....	....	1.12	-1.9	3	....	se.	....	....	....	14	9	7	....	
West Gulf States.							64.7	-2.4										71	2.30	-1.6										4.6	
Shreveport	249	77	84	29.81	30.07	+.09	63.0	-3.4	84	21	74	37	6	52	32	54	48	64	2.28	-2.9	9	5,950	se.	33	nw.	4	13	9	8	4.5	
Fort Smith	481	63	72	29.54	30.05	+.10	59.8	-2.4	83	17	70	34	6	50	34	52	46	66	2.73	-2.3	11	5,136	e.	36	nw.	13	14	8	8	4.2	
Little Rock	302	71	79	29.76	30.08	+.09	59.5	-3.7	83	30	69	32	6	50	31	51	44	63	2.76	-2.0	10	6,115	nw.	41	nw.	25	11	10	9	5.5	
Corpus Christi	20	42	50	30.03	30.05	+.07	69.8	-1.5	87	26	76	51	•	64	29	65	63	82	2.41	+0.8	6	9,207	se.	40	ne.	13	13	9	8	4.2	
Galveston	42	85	96	30.02	30.06	+.07	67.5	-2.1	84	26	72	50	6	63	19	62	59	78	3.04	+0.2	5	8,257	s.	36	nw.	4	16	7	7	3.8	
Palestine	510	54	61	29.52	30.07	+.08	64.2	-2.5	83	24	75	39	6	54	39	58	55	77	1.43	-3.2	6	5,670	ne.	25	sw.	22	12	10	8	5.3	
San Antonio	704	95	104	29.30	30.04	+.07	69.0	-1.1	93	26	80	41	5	58	34	59	53	66	1.46	-1.5	7	7,118	se.	36	n.	4	13	7	10	4.7	
Ohio Val. & Tenn.							52.1	-3.8										64	2.58	-1.4										5.3	
Chattanooga	762	106	112	29.28	30.09	+.07	55.4	-5.5	82	17	65	30	6	46	34	48	40	62	4.83	+0.2	12	5,681	nw.	36	w.	18	12	10	8	4.9	
Knoxville	1,004	10	88	29.00	30.08	+.06	53.0	-5.2	81	30	64	29	7	42	36	46	40	68	3.34	-1.6	13	5,578	sw.	34	sw.	18	15	7	8	4.2	
Memphis	399	140	154	29.65	30.08	+.09	58.7	-3.4	84	30	67	35	6	51	25	50	42	59	2.30	-3.2	9	7,678	nw.	54	nw.	26	16	4	10	5.1	
Nashville	545	128	134	29.48	30.07	+.09	54.4	-5.4	80	30	64	30	6	45	33	47	39	63	3.16	-1.6	11	5,697	nw.	33	ne.	14	14	7	9	4.2	
Lexington	989	75	104	29.00	30.07	+.06	50.7	-3.8	77	17	59	22	5	42	26	43	35	60	3.29	-0.5	11	8,264	ne.	42	sw.	20	5	10	15	6.9	
Louisville	525	114	136	29.49	30.07	+.07	53.5	-2.9	82	30	63	25	5	44	28	45	37	60	2.80	-1.7	10	6,685	n.	36	ne.	5	6	12	12	6.0	1.7
Evansville	434	72	82	....	....	....	53.8	....	80	30	62	29	6	45	28	....	....	....	4.15	....	12	5,706	nw.	32	sw.	13	13	8	9	4.8	....
Indianapolis	823	154	164	29.17	30.06	+.07	50.3	-2.6	76	17	60	20	5	41	28	43	36	61	1.73	-2.0	8	7,759	n.	36	w.	19	9	10	11	5.7	T.
Cincinnati	628	152	157	29.38	30.06	+.06	50.6	-4.0	77	17	59	22	5	42	27	44	38	66	1.15	-2.0	9	5,960	nw.	33	w.	19	13	7	10	4.8	1.0
Columbus	824	87	100	29.16	30.05	+.06	48.6	-2.6	80	17	58	22	5	39	30	43	38	72	2.05	-1.1	10	6,241	nw.	33	w.	9	13	5	12	5.4	T.
Pittsburg	842	116	123	29.12	30.04	+.04	48.5	-2.7	78	17	57	20	5	40	30	43	37	69	1.60	-1.2	13	5,240	nw.	25	nw.	20	6	10	14	6.6	2.2
Parkersburg	638	77	84	29.36	30.06	+.06	49.4	-3.8	82	17	60	20	6	39	33	43	36	65	2.17	-1.2	12	5,041	nw.	30	nw.	29	10	7	13	5.5	7.0
Lower Lake Region.							44.2	-0.5										66	1.73	-0.6										5.7	
Buffalo	768	178	206	29.17	30.01	+.03	43.4	+1.7	65	13	50	19	4	37	25	37	31	64	1.37	-1.1	9	10,454	ne.	57	sw.	20	5	14	11	6.3	0.3
Oswego	335	76	87	29.61	29.99	.00	41.3	-1.0	60	13	47	19	5	35	27	37	31	68	2.32	+0.2	14	7,806	w.	31	se.	19	10	8	12	5.1	3.6
Rochester	523	81	90	29.42	30.00	+.01	43.5	0.0	67	17	52	19	5	36	28	38	30	64	1.72	-0.8	16	5,998	nw.	26	nw.	21	11	9	10	5.2	2.4
Erie	714	92	102	29.26	30.04	+.06	43.0	-1.1	62	13	49	20	4	37	20	39	34	74	1.83	-0.7	11	7,961	ne.	48	s.	19	8	10	12	6.1	3.2
Cleveland	762	190	201	29.20	30.04	+.04	44.1	-1.6	66	13	50	20	5	38	22	38	31	62	1.62	-0.6	8	10,273	n.	48	w.	20	9	10	11	5.5	0.1
Sandusky	629	62	74	29.36	30.05	+.05	46.1	-0.9	70	16	53	21	5	39	28	40	35	68	1.95	-0.5	11	6,657	ne.	33	nw.	6	5	10	15	6.6	0.2
Toledo	674	122	127	29.31	30.05	+.07	46.6	-0.9	72	17	55	18	5	38	31	40	32	62	1.51	-0.7	8	7,300	nw.	35	se.	18	10	9	11	5.5	T.
Detroit	730	160	166	29.25	30.05	+.06	45.4	-0.3	66	12	54	18	5	37	25	39	32	63	1.51	-0.7	10	7,078	ne.	43	w.	20	10	11	9	5.5	0.8
Upper Lake Region.							41.7	+1.0										70	1.37	-1.0										5.1	
Alpena	609	61	65	29.40	30.08	+.08	40.0	+2.9	64	11	48	14	5	32	29	36	31	73	1.47	-0.7	7	7,163	nw.	40	e.	19	9	12	9	5.4	1.7
Grand Haven	628	55	64	29.36	30.06	+.08	43.8	+0.2	68	14	53	15	5	35	35	38	32	68	1.71	-0.8	9	6,783	nw.	36	nw.	19	9	8	13	5.7	T.
Marquette	734	67	95	29.28	30.09	+.09	38.4	+1.2	66	12	44	17	4	32	27	35	29	70	1.72	-0.3	7	7,328	nw.	39	s.	27	10	14	6	5.3	12.0
Port Huron	639	70	108	29.36	30.07	+.08	42.0	+0.3	67	12	50	15	3	34	34	37	32	72	1.24	-0.9	9	8,391	n.	40	w.	20	11	8	11	5.3	1.0
Sault Ste. Marie	624	58	65	29.38	30.07	+.07	39.2	+1.5	63	12	49	8	2	30	34	34	29	71	0.68	-0.9	4	6,883	nw.	50	se.	19	15	8	7	4.1	0.2
Chicago	824	241	274	29.18	30.08	+.10	44.4	-1.2	76	16	50	19	5	38	28	39	34	70	0.76	-2.3	8	13,477	n.	48	ne.	5	13	7	10	4.6	T.
Milwaukee	671	106	149	29.35	30.09	+.10	44.0	+1.3	80	16	51	24	5	37	35	38	32	68	1.77	-1.1	12	8,080	ne.	40	n.	13	6	7	17	6.7	0.8
Greenbay	617	49	57	29.40	30.09	+.10	43.4	+0.4	73	16	52	16	5	34	32	37	32	70	2.57	+0.4	9	6,039	n.	29	n.	13	10	12	8	4.8	3.0
Duluth	702	95	106	29.31	30.08	+.08	40.3	+2.4	64	29	47	18	4	34	24	35	28	65	0.41	-2.0	5	6,341	ne.	42	s.	27	10	16	4	4.1	2.5
North Dakota.							42.7	+0.7										64	1.53	-0.4										4.3	
Moorhead	935	54	60	29.03	30.07	+.09	42.8	+1.5	72	11	56	14	6	30	42	36	29	66	2.38	+0.2	9	8,324	se.	48	se.	7	10	15	5	4.3	0.2
Bismarck	1,674	16	29	28.26	30.07	+.10	43.7	+1.6	79	14	55	18	6	32	41	36	29	61	1.12	-1.2	5	9,396	nw.	48	nw.	27	16	10	4	4.2	0.1
Williston	1,875	15	31	28.04	30.06	+.09	41.7	-0.9	85	26	52	9	5	31	39	36	29	66	1.08	-0.3	8	7,706	n.	60	n.	27	14	10	6	4.4	T.
Upper Miss. Valley.							49.9	-1.3										66	3.04	0.0										5.1	
Minneapolis	....	90	....	....	....	....	45.4	-1.7	78	15	55	18	5	36	40	....	....	....	1.46	-1.3	10	....	ne.	....	....	....	8	11	11	....	2.1
St. Paul	837	114	124	29.15	30.07	+.10	45.6	+0.4	77	15	55	19	5	36	39	38	30	60	1.22	-1.2	9	5,483	nw.	30	se.	30	14	6	10	5.0	2.0
La Crosse	720	70	78	....	....	....	46.7	-0.7	76	16	56	17	5	37	36	....	....	....	3.07	+0.8	13	5,281	n.	28	s.	30	10	11	9	5.6	T.
Davenport	599	71	79	29.39	30.04	+.06	49.4	-0.3	80	16	58	24	5	40	29	43	36	64	3.01	+0.2	9	5,687	ne.	30	nw.	25	10	6	14	6.1	T.
Des Moines	867	84	88	29.15	30.09	+.13	50.0	-0.5	90	16	61	25	5	39	41	43	36	63	2.64	-0.2	11	6,756	ne.	33	sw.	16	16	7	7	4.1	

TABLE I.—*Climatological data for Weather Bureau Stations, April, 1898*—Continued.

Stations.	Elevation of instruments			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.									Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches.			Wind.					Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
	Barometer above sea level, feet.	Thermometers above ground.	Anemometers above ground.	Mean actual, 8 a. m. and 8 p. m. ÷ 2.	Mean reduced.	Departure from normal.	Mean max. and min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.				Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity: Miles per hour.	Maximum velocity: Direction.	Maximum velocity: Date.					
Up. Miss. Val.—Con																															
Dubuque	698	101	109	29.30	30.06	+ .09	47.6	− 1.0	82	16	57	22	5	38	31	41	34	66	4.06	+ 1.3	10	6,293	nw.	32	nw.	20	16	7	7	3.9	T.
Keokuk	614	64	78	29.40	30.07	+ .11	51.8	− 0.2	80	16	60	25	5	43	28	45	40	70	4.80	+ 1.6	14	6,198	nw.	32	nw.	13	11	10	9	4.8	T.
Cairo	359	87	93	29.66	30.05	+ .08	55.6	− 3.3	81	30	64	32	6	47	27	51	47	77	2.13	− 1.8	11	7,551	nw.	46	w.	13	8	14	8	5.4	
Springfield, Ill.	644	82	92	29.36	30.06	+ .07	50.6	− 2.8	79	17	59	25	5	42	28	44	37	65	3.76	0.0	12	7,661	s.	30	ne.	4	9	8	13	6.0	T.
Hannibal	534	75	107	...	...	...	51.7	− 2.0	82	16	61	26	6	43	33	...	...	...	3.48	+ 1.0	11	7,592	nw.	42	nw.	13	11	10	9	5.1	
St. Louis	567	111	210	29.46	30.08	+ .11	54.4	− 1.8	82	16	63	29	5	46	31	47	40	63	3.85	+ 0.1	15	7,903	nw.	47	w.	13	11	8	11	5.4	T.
Missouri Valley.							50.6	− 1.6										62	2.84	− 0.2										5.0	
Columbia	...	4	84	...	...	...	52.2	− 5.3	84	16	63	21	6	41	40	...	...	...	2.76	− 1.8	13	7,194	n.	60	nw.	13	10	6	14	5.8	
Kansas City	963	78	95	29.06	30.10	+ .04	53.3	− 1.1	85	16	62	31	5	44	30	46	39	65	3.77	+ 0.8	13	6,557	nw.	39	nw.	13	10	9	11	5.2	
Springfield, Mo.	1,324	100	103	28.65	30.06	+ .09	52.8	− 4.7	79	16	61	25	6	45	29	46	39	66	3.68	− 0.2	14	8,716	se.	45	nw.	13	7	15	8	5.3	
Topeka	...	81	...	...	...	...	53.0	− 3.8	86	16	63	29	6	43	34	...	...	...	5.27	+ 3.0	10	...	e.	...	...	...	9	14	7	...	
Lincoln	1,199	74	84	28.77	30.06	+ .09	50.7	− 0.7	87	16	62	26	5	40	35	44	37	65	3.88	+ 1.4	9	9,768	n.	40	nw.	9	13	13	4	4.4	
Omaha	1,103	92	97	28.88	30.07	+ .11	51.2	+ 0.2	88	16	61	26	5	41	33	43	34	57	2.74	− 0.4	12	6,527	n.	30	nw.	18	14	6	10	4.8	
Sioux City	1,139	96	164	...	...	...	49.6	− 1.0	88	16	61	19	*	38	37	...	...	...	1.37	− 1.7	7	10,586	nw.	44	nw.	27	12	8	10	4.9	
Pierre	1,460	50	62	28.50	30.06	+ .07	48.2	− 0.9	92	15	62	13	6	35	54	39	30	57	0.90	− 1.0	7	8,741	se.	58	nw.	27	12	8	10	5.1	
Huron	1,306	56	67	28.65	30.07	+ .09	45.4	− 1.0	86	15	59	15	5	32	48	37	28	61	2.89	0.0	10	10,668	nw.	60	s.	7	12	10	8	5.4	
Yankton	1,234	52	58	...	...	...	49.4	+ 2.7	86	15	62	18	5	37	37	...	...	...	1.13	− 1.9	8	8,404	n.	46	s.	27	15	8	7	4.2	T.
Northern Slope.							45.4	+ 0.7										56	1.10	− 0.5										5.1	
Havre	2,494	46	47	27.35	30.01	+ .04	42.3	− 1.7	83	25	53	− 2	1	31	45	36	29	69	1.50	+ 0.5	10	8,394	w.	48	w.	8	11	12	7	5.1	1.0
Miles City	2,372	41	49	27.49	30.00	+ .02	47.4	+ 0.8	88	26	60	12	1	35	44	39	32	66	0.77	− 0.3	8	7,718	nw.	48	nw.	26	5	18	7	5.2	T.
Helena	4,108	88	93	25.86	30.09	+ .09	45.4	+ 1.9	80	25	56	14	1	35	39	36	24	49	0.56	− 0.6	7	6,266	sw.	38	sw.	26	15	9	6	4.1	3.8
Rapid City	3,251	46	50	26.63	30.03	+ .02	45.6	− 1.0	87	26	58	17	1	34	46	37	26	56	1.66	− 0.6	11	7,228	nw.	48	nw.	27	8	9	13	6.5	3.1
Cheyenne	6,105	58	60	24.01	30.07	+ .06	42.8	+ 1.9	79	26	57	11	1	29	43	33	17	46	0.68	− 0.7	8	8,361	nw.	48	w.	8	10	13	7	4.8	1.6
Lander	5,372	28	36	24.65	30.05	+ .05	45.3	+ 2.8	78	26	59	14	1	31	46	36	21	49	1.08	− 1.2	7	3,995	sw.	34	sw.	7	10	11	9	5.1	6.9
North Platte	2,826	43	52	27.11	30.07	+ .10	49.0	+ 0.4	86	15	62	22	6	36	49	40	32	60	1.42	− 0.8	6	9,269	nw.	44	s.	29	12	14	4	4.6	T.
Middle Slope.							53.6	− 0.5										56	1.89	− 0.1										4.7	
Denver	5,290	79	151	24.73	30.05	+ .07	49.4	+ 2.5	83	26	63	20	2	36	49	39	25	50	1.20	− 0.8	10	6,085	s.	58	sw.	29	9	15	6	5.5	8.9
Pueblo	4,713	74	81	25.27	30.01	+ .07	52.2	+ 1.7	82	26	67	21	2	37	49	40	27	47	1.11	− 0.3	5	6,784	e.	52	n.	3	10	14	6	4.9	0.3
Concordia	1,398	42	47	28.56	30.06	+ .08	52.9	− 2.4	87	16	65	23	2	41	38	44	36	59	1.95	− 0.1	10	6,435	s.	39	se.	29	11	9	10	5.3	
Dodge City	2,504	44	52	27.42	30.04	+ .02	54.6	+ 0.9	87	21	68	19	2	41	44	44	35	57	0.97	− 0.6	10	10,301	s.	50	s.	7	12	14	4	4.0	0.2
Wichita	1,351	78	85	28.62	30.06	+ .11	54.6	− 3.2	86	16	66	26	6	43	37	46	38	61	5.16	+ 2.9	9	7,399	n.	34	n.	4	13	10	7	4.6	
Oklahoma	1,218	54	62	28.75	30.05	+ .10	57.8	− 2.6	83	16	70	28	6	46	36	50	43	63	0.95	− 1.9	6	9,662	s.	50	s.	30	18	5	7	3.8	
Southern Slope.							60.3	− 0.9										52	1.38	− 0.4										4.2	
Abilene	1,749	45	54	28.23	30.05	+ .09	64.6	− 0.7	92	27	76	34	5	53	33	53	44	58	1.78	− 0.9	4	9,193	se.	48	w.	3	13	12	5	4.0	
Amarillo	3,691	54	61	26.27	30.03	+ .09	56.0	− 1.1	89	27	70	22	6	42	40	44	30	47	0.98	+ 0.1	8	13,982	s.	66	w.	21	13	14	3	4.4	T.
Southern Plateau.							64.9	+ 3.2										34	0.59	+ 0.3										2.9	
El Paso	3,767	10	110	26.17	29.95	+ .02	65.0	+ 1.2	91	27	78	39	5	52	39	47	25	31	0.81	+ 0.7	5	9,204	ne.	56	w.	21	18	9	3	2.8	
Santa Fe	6,998	47	50	23.27	30.00	+ .05	49.4	+ 2.8	74	27	61	26	4	38	32	38	20	41	1.37	+ 0.6	7	5,859	se.	36	sw.	29	14	11	5	4.1	
Phœnix	1,076	47	57	28.72	29.83	− .07	71.7	+ 5.0	102	25	87	41	4	57	43	53	34	30	0.18	− 0.1	2	3,555	e.	26	e.	13	22	5	3	2.3	
Yuma	139	16	50	29.70	29.84	− .07	73.5	+ 3.7	107	25	90	44	3	57	43	...	38	35	0.01	− 0.1	1	5,391	w.	44	w.	28	19	10	1	2.5	
Middle Plateau.							52.1	+ 3.8										45	0.68	− 0.6										3.6	
Carson City	4,720	82	92	25.25	30.00	.00	51.2	+ 3.0	80	24	66	23	4	36	46	39	23	41	0.43	− 0.4	4	5,871	w.	49	w.	20	14	14	2	3.5	2.1
Winnemucca	4,340	59	70	25.66	30.02	+ .04	51.2	+ 3.9	83	25	66	21	4	36	45	43	33	54	0.32	− 0.6	3	7,929	sw.	43	sw.	20	12	9	9	4.8	T.
Salt Lake City	4,344	83	90	25.64	30.02	+ .02	54.0	+ 4.5	83	26	66	27	3	42	40	42	27	39	1.30	− 0.9	5	5,018	nw.	38	w.	20	8	12	10	5.5	5.0
Northern Plateau.							49.6	+ 2.2										55	0.76	− 0.6										4.9	
Baker City	3,470	49	55	26.45	30.05	+ .03	47.6	+ 3.0	83	25	60	24	19	35	41	38	25	48	0.27	− 0.9	6	5,719	s.	28	se.	6	6	12	12	6.2	1.3
Idaho Falls	4,742	10	56	25.23	30.04	+ .04	47.2	+ 3.4	79	25	63	21	5	32	44	38	30	60	0.19	− 1.3	5	8,455	s.	51	sw.	26	20	5	5	3.2	0.8
Spokane	1,943	99	107	27.98	30.04	+ .05	50.0	+ 2.0	78	25	62	29	3	38	34	41	30	51	0.76	− 0.6	7	5,046	sw.	30	sw.	7	8	13	9	5.7	
Walla Walla	1,018	65	73	28.97	30.06	+ .06	53.8	+ 0.5	81	25	65	34	3	42	37	47	39	62	1.83	+ 0.2	8	4,486	s.	31	w.	7	10	19	1	4.4	
N. Pac. Coast Reg.							48.9	+ 0.5										72	2.87	− 1.4										5.8	
Fort Canby	179	10	34	29.91	30.11	+ .07	48.0	0.0	67	12	53	37	3	43	18	45	43	86	3.80	− 1.7	16	9,245	n.	60	se.	7	7	10	13	6.4	
Port Angeles	29	47	62	...	...	...	45.2	+ 0.6	67	30	53	30	18	38	29	...	...	...	0.80	− 1.2	10	4,595	e.	24	w.	9	9	15	6	4.9	
Pysht	...	5	...	...	...	...	47.8	+ 1.3	83	29	58	29	3	37	40	...	...	...	3.51	− 1.5	13	...	w.	...	...	...	15	3	12	...	
Seattle	119	114	121	29.97	30.10	+ .08	50.0	+ 0.1	78	24	58	32	3	42	33	45	39	68	1.51	− 1.7	15	3,771	se.	24	s.	7	9	7	14	5.9	
Tacoma	213	113	120	...	...	...	49.2	+ 0.3	76	24	58	30	3	40	34	...	...	...	2.26	− 1.2	13	4,178	n.	26	sw.	7	11	6	13	5.8	
Tatoosh Island	86	7	21	30.02	30.12	+ .10	46.6	+ 0.5	58	24	50	38	3	43	15	43	39	75	6.70	− 0.7	15	8,452	e.	38	w.	7	9	5	16	6.5	
Astoria	...	18	...	...	...	...	49.8	+ 1.1	71	12	57	35	*	43	23	...	...	...	4.02	− 2.0	11	...	nw.	...	...	...	9	7	14	...	
Portland, Oreg	153	203	213	29.94	30.10	+ .05	51.6	0.0	81	24	61	32	2	43	34	45	38	65	2.12	− 1.2	10	6,239	nw.	40	s.	22	11	8	11	5.2	
Roseburg	521	56	67	29.52	30.09	+ .02	51.9	+ 0.7	84	12	63	29	3	40	43	45	38	67	1.07	− 1.5	9	2,921	nw.	24	e.	30	9	8	13	6.0	
Mid. Pac. C'st Reg.							55.8	+ 1.3										64	0.83	− 1.6										4.1	
Eureka	64	60	69	30.06	30.12	+ .06	48.8	− 0.8	64	12	54	35	3	43	24	46	43	83	2.78	− 1.4	10	6,432	nw.	36	nw.	29	10	9	11	6.0	
Redbluff	334	54	58	29.63	29.98	− .02	64.4	+ 5.1	96	24	78	43	8	51	38	51	37	42	0.63	− 1.5	2	5,174	se.	35	n.	30	18	10	2	3.2	
Sacramento	71	106	117	29.91	29.98	− .04	61.4	+ 3.2	89	24	76	39	7	47	37	51	42	55	0.28	− 2.0	2	6,752	se.	32	n.	11	19	10	1	3.0	
San Francisco	153	161	167	29.89	30.05	+ .01	54.4	− 0.2	87	12	61	44	2	48	33	49	45	78	0.19	− 1.8	1	8,842	sw.	42	w.	27	17	13	0	4.1	
Point Reyes Light	...	12	...	...	...	...	49.8	− 0.6	80	12	55	42	*	44	30	...	...	...	0.29	− 1.4	1	...	nw.	...	...	...	17	8	5	...	
S. Pac. Coast Reg.							61.8	+ 3.0										61	0.08	− 1.2										3.1	
Fresno	332	67	70	29.59	29.93	− .09	65.4	+ 4.6	101	25	81	39	3	50	40	50	35	40	0.00	− 1.3	0	4,779	nw.	25	nw.	20	25	5	0	1.8	
Los Angeles	330	74	82	29.61	29.96	− .05	62.8	+ 3.9	99	13	74	41	1	51	41	53	47	68	0.03	− 1.3	1	3,401	w.	20	w.	2	15	12	3	3.6	
San Diego	87	94	102	29.87	29.97	− .06	59.1	+ 0.8	86	13	65	45	3	53	34	54	50	77	0.22	− 0.5	4	4,544	nw.	24	nw.	2	18	3	9	3.9	
San Luis Obispo	201	10	46	29.81	30.03	.00	59.7	+ 2.9	97	13	74	37	3	45	53	50	42	60	0.06	− 1.9	2	4,374	w.	20	w.	2	17	9	4	3.0	

NOTE.—The data at stations having no departures are not used in computing the district averages. Letters of the alphabet denote number of days missing from the record. *Two or more dates. † Received too late to be considered in departures, etc.

TABLE II.—*Meteorological record of voluntary and other cooperating observers, April, 1898.*

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
Alabama.					
Alco †	86	33	60.6	2.69	
Ashville †	88	28	56.7	5.37	
Bermuda †	85	33	62.4	4.34	
Birmingham †	83	28	57.8	4.71	
Bridgeport †	......	......	......	5.20	
Citronelle †	81	37	63.0	5.11	
Clanton † *	81	31	58.2	2.98	
Decatur †	82	26	55.0	3.65	
Demopolis	......	......	......	3.70	
Eufaula *a* †	84	33	60.0	5.60	
Eufaula *b*	......	......	......	5.56	
Evergreen *	79	34	59.4	1.38	
Florence *a* †	......	......	......	3.12	
Florence *b* †	83	29	57.2	3.16	
Fort Deposit	84	32	62.0	4.87	
Gadsden	84	29	56.0	6.79	
Goodwater	84	32	58.6	4.41	
Greensboro †	85	31	59.0	3.81	
Hamilton	......	29	......	5.22	
Healing Springs	81	31	59.2	3.35	
Highland Home †	83	32	61.0	4.34	
Jasper	......	25	......	5.67	
Livingston	82	33	60.6	3.60	
Lock No. 4	80	31	55.4	4.18	
Madison Station †	83	25	54.2	4.35	
Marion †	80	30	60.2	5.50	
Mount Willing †	85	32	59.8	4.22	
Newbern †	85	31	60.3	4.19	
Newburg	82	27	57.6	5.40	
Newton †	86	32	60.6	1.60	
Oneonta	81	26	55.8	6.09	
Opelika †	85	33	58.6	4.11	
Oxanna †	79	27	53.8	4.17	
Pineapple	84	......	......	4.85	
Pushmataha †	86	28	61.4	4.01	
Riverton †	83	27	54.5	4.44	
Rockmills †	......	......	......	6.49	
Scottsboro †	81	29	55.0	3.87	
Selma †	83	32	60.3	4.06	
Sturdevant	......	......	......	3.75	
Talladega	86	30	57.1	5.03	
Tallassee	......	......	......	5.25	
Thomasville	83	33	61.4	3.82	
Tuscaloosa †	88	30	57.7	3.73	
Tuscumbia	82	30	56.1	2.83	
Union †	86	......	......	3.13	
Union Springs †	88	33	60.8	5.12	
Uniontown †	85	34	62.0	5.79	
Valleyhead	83	27	54.2	4.90	
Warrior	......	......	......	8.57	
Wetumpka	82	32	59.4	6.05	
Wilsonville †	......	......	......	4.83	
Alaska.					
Killisnoo	48	24	37.8	6.80	......
Arizona.					
Arizona Canal Co. Dam	102	40	70.2	0.08	
Benson *5	90	47	67.4	0.00	
Bisbee †	85	43	63.4	0.47	
Buckeye †	103	38	70.4	0.00	
Calabasas	93	40	64.5	0.60	
Casa Grande *5	90	50	68.4	0.10	
Congress	95	41	69.8	0.18	
Dragoon	......	......	......	1.44	
Dragoon Summit *5	87	38	62.3	0.75	
Dudleyville	97	34	66.9	1.12	
Empire Ranch	......	......	......	0.66	
Flagstaff †	83	22	52.0	2.50	0.5
Fort Apache	84	30	56.2	0.50	
Fort Defiance	78	20	48.8	0.31	
Fort Grant †	86	36	62.6	1.60	
Fort Huachuca †	88	31	60.8	0.59	
Gilabend *a* *5	104	48	75.4	0.00	
Holbrook †	88	21	56.0	0.76	
Jerome	92	33	66.4	0.45	
Lochiel *1	85	36	59.9	0.46	
Maricopa *5	102	54	78.6	T.	
Mesa †	99	40	70.6	0.10	
Mount Huachuca	85	33	60.0	0.45	
Music Mountain	98	32	65.4	0.91	
Natural Bridge	......	......	......	0.44	
Oracle	90	38	63.2	1.38	
Oro	......	......	......	1.52	
Oro Blanco	92	33	63.4	0.60	
Pantano *5	98	50	67.8	0.45	
Parker	113	41	74.6	0.05	
Peoria †	98	43	71.4	0.02	
Phœnix	99	35	69.4	0.00	
Pinal Ranch	......	......	......	0.65	
St. Helena Ranch	......	......	......	0.68	
San Carlos †	100	33	67.6	0.60	
San Simon *5	91	41	69.8	......	
Showlow	......	......	......	0.35	0.1
Signal †	102	41	71.2	0.27	
Snowflake	85	19	54.8	0.51	
Strawberry	83	22	53.0	0.89	
Sulphur Spring Valley	......	......	......	0.56	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
***Arizona*—Cont'd.**					
Texas Hill *5	108	50	80.6	0.03	
Tombstone	88	36	63.7	0.83	
Tucson *c* †	95	34	67.4	1.05	
Walnut Grove	......	......	......	T.	
Whipple Barracks †	90	25	57.2	0.23	
White Hills	100	39	69.4	0.00	
Willcox *5	82	34	55.0	0.27	
Williams	81	20	50.7	0.40	T.
Arkansas.					
Amity	82	30	59.4	2.72	
Arkansas City †	......	......	......	2.35	
Beebranch	81[a]	25[a]	62.2[a]	5.30	
Blanchard Springs †	85	29	60.0	1.89	
Brinkley	83	30	57.4	1.81	
Camden *a* †	......	......	......	1.80	
Camden *b* †	82	32	60.4	......	
Canton *1	83	29	56.3		
Conway	84	28	60.3	3.83	
Corning	85	27	56.6	3.52	
Dallas	82	31	60.1	3.19	
Dardanelle	......	......	......	2.96	
Elon †	85	28	60.1	3.02	
Fayetteville †	82	25	56.0	3.93	
Fulton †	......	......	......	1.10	
Hardy	84	29	56.6	3.66	
Helena *a* †	......	......	......	3.99	
Helena *b*	86	32	60.4	3.83	
Hot Springs *a*	84	30	60.8	2.52	
Hot Springs *b*	......	......	......	2.56	
Jonesboro	84	29	57.1	2.89	
Keesees Ferry †	85	26	56.4	2.66	
Lacrosse †	82	30	57.2	3.75	
Lonoke *1	85	32	59.9	1.61	
Luna Landing *5	80	35	63.9	3.65	
Lutherville *1	93	27	59.8	......	
Magnolia	84	35	63.0	2.12	
Malvern †	85	37[a]	59.8[a]	2.88	
Marianna *1	86	34	61.8	......	
Marvell	84	32	59.9	2.75	
Mena *1	77	32	60.0	2.03	
Monticello	86	30	61.2	2.37	
Moore	......	......	......	7.85	
Mossville	76	29	54.2	6.12	
New Gascony *1	82	31	59.6	2.10	
Newport *a* †	......	......	......	2.95	
Newport *b*	82	30	56.5	2.84	
Newport *c* †	86	30	58.3	2.56	
Oregon *1	80	22	52.8	......	
Osceola	85	30	57.0	2.91	
Ozark †	86	33	59.7	3.58	
Picayune †	89	28	59.8	2.32	
Pinebluff †	86	32	61.0	1.60	
Pocahontas †	82	29	56.7	3.50	
Pond	82	19	50.7	2.61	
Prescott	86	33	61.2	2.70	
Rison	86	28	61.0	3.97	
Russellville	82	30	57.9	4.59	
Silver Springs †	84	25	56.4	3.21	
Spielerville	83	30	59.6	3.37	
Stamps	88	32	62.6	2.63	
Stuttgart †	80	31	59.4	2.30	
Texarkana †	......	......	......	1.63	
Warren †	84	28	60.2	3.49	
Washington * † 1	84	36	62.8	2.11	
Wiggs *1	85	29	62.0	2.71	
Winslow	77	25	54.2	5.47	
Witts Springs †	78	29	55.4	4.07	
California.					
Agnew	90	30	55.6	0.00	
Arlington Heights	104	36	64.1	0.18	
Athlone *1	98	43	63.0	0.08	
Ballast Point L. H	......	......	......	0.16	
Bear Valley	......	......	......	1.65	7.0
Berkeley	85	41	56.4	0.19	
Bishop †	88	21	58.1	0.21	T.
Boca *1	78	17	43.5	1.30	12.0
Bodie †	71	9	39.7	0.28	3.0
Bowmans Dam	......	......	......	2.10	10.0
Caliente *1	95	37	63.8	0.76	
Campbell	89	32	56.6	0.19	
Cape Mendocino L. H.	......	......	......	4.40	
Cedarville †	82	20	50.3	0.33	3.0
Centerville *1	96	46	60.1	0.39	
Chico *1	97	45	64.7	0.47	
Chino *5	102	43	65.8	0.00	
Cisco *1	66	26	40.7	......	8.0
Claremont †	99	30	63.2	0.73	
Corning *1	93	43	61.4	T.	
Craftonville	101	33	69.4	0.23	
Crescent City †	70	33	48.8	4.23	
Crescent City L. H	......	......	......	3.87	
Delano *1	94	45	67.2	0.00	
Delta *1	90	38	59.8	1.35	
Descanso	......	......	......	0.90	
Drytown	91	34	59.1	0.84	
Dunnigan *1	92	45	62.6	0.14	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
***California*—Cont'd.**					
Durham *1	91	36	62.6	0.29	
East Brother L. H.	......	......	......	0.10	
Edmanton *1	81	26	50.7	1.25	7.0
Elsinore	109	31	65.6	0.23	
Escondido	103	26	61.1	0.48	
Fallbrook	......	......	......	0.46	
Folsom City *1	95	44	63.8	0.54	
Fordyce Dam	......	......	......	2.38	16.0
Fort Bragg †	......	......	......	1.09	
Fort Ross	76	38	52.6	0.57	
Georgetown	84	33	57.5	1.92	
Glendora	......	......	......	1.03	
Goshen *1	100	36	69.0	0.00	
Grand Island *5	96	44	65.8	0.16	
Grass Valley	......	......	......	0.97	
Greenville †	86	18	50.4	0.82	1.0
Healdsburg *1	80	32	56.0	0.33	
Hill Ranch	108	31	64.9	0.02	
Hollister *1	94	40	59.9	0.78	
Humboldt L. H.	......	......	......	2.83	
Indio *1	105	48	75.9	0.00	
Iowa Hill *1	82	34	55.4	0.99	2.5
Jackson	102	30	60.7	1.11	
Jolon	......	......	......	0.07	
Keene *1	87	30	56.8	0.35	
Kennedy Gold Mine	89	34	58.8	1.18	
King City *1	98	40	52.8	0.05	
Kingsburg *1	95	45	68.2	0.00	
Kono Tayee	84	40	59.8	0.64	
Lagrange *5	100	40	65.7	0.85	
Laporte * † 1	75	27	45.9	1.49	11.5
Lemoore *a* *1	98	41	66.4	0.00	
Lick Observatory	76	27	50.8	0.84	1.0
Limekiln	100	37	66.8	......	
Lime Point L. H	......	......	......	0.07	
Lodi	93	35	61.4	0.40	
Los Gatos *b*	88	37	56.7	0.34	
Malakoff Mine *1	88	29	57.5	1.18	1.5
Mammoth Tank *1	109	55	78.5	0.00	
Manzana	93	30	57.7	0.00	
Mare Island L. H	......	......	......	0.54	
Merced *1	96	44	62.0	0.07	
Mills College	......	......	......	0.32	
Milo	......	......	......	0.12	
Modesto *1	95	44	66.0	0.00	
Mohave *1	100	40	62.1	0.00	
Mokelumne Hill *5	......	37	57.2	0.47	
Monterey *1	72	42	55.5	0.24	
Mount Tamalpais	80	34	56.0	0.60	
Napa *b*	93	34	57.8	0.34	
Needles	105	49	76.6	0.00	
Nevada City	82	28	54.1	0.95	
Newhall *1	104	40	62.6	0.10	
North Ontario	95	33	59.6	0.50	
North San Juan *1	90	40	63.0	1.00	
Oakland *a*	84	40	56.9	0.19	
Ogilby *1	110	50	79.7	0.00	
Oleta *1	85	37	58.8	0.68	
Orland *1	99	33	69.7	0.00	
Palermo	94	38	62.7	0.59	
Paso Robles *b*	97	33	55.9	0.00	
Peachland *5	88	37	59.1	0.37	
Piedras Blancas L. H	......	......	......	0.30	
Pigeon Point L. H	......	......	......	0.12	
Pilot Creek	......	......	......	1.22	5.0
Pine Crest	95	44	63.2	0.00	
Placerville	83	29	54.9	0.58	
Point Ano Nuevo L. H	......	......	......	0.00	
Point Arena L. H	......	......	......	0.80	
Point Bonita L. H	......	......	......	0.18	
Point Conception L. H	......	......	......	0.00	
Point Fermin L. H	......	......	......	0.05	
Point George L. H	......	......	......	1.17	
Point Hueneme L. H	......	......	......	0.03	
Point Loma L. H	......	......	......	0.12	
Point Montara L. H	......	......	......	0.31	
Point Pinos L. H	......	......	......	0.35	
Point Reyes L. H	......	......	......	0.29	
Point Sur L. H	......	......	......	0.25	
Pomona (near)	104	36	64.0	0.06	
Poway *5	97	42	57.1	0.33	
Quincy †	81	24	51.7	1.01	
Redding *b* †	92	40	63.2	0.76	
Represa	86	38	60.6	0.45	
Rio Vista	94	40	62.9	0.28	
Roe Island L. H	......	......	......	0.30	
Rosewood	96	30	60.3	0.40	
Sacramento *a*	93	38	62.6	0.35	
Salinas *1	80	43	58.0	0.22	
Salton *1	117	50	82.1	0.00	
San Bernardino †	102	32	63.9	0.48	
San Leandro *1	90	47	58.4	0.38	
San Luis L. H	......	......	......	0.05	
San Mateo *1	87	45	61.3	0.25	
San Miguel *1	95	40	61.3	0.00	
San Miguel Island	86	40	57.2	0.02	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
California—Cont'd.	°	°	°	*Ins.*	*Ins.*
Santa Barbara *a*	95	40	60.2	T.	
Santa Barbara L. H.	......	......	......	0.00	
Santa Clara *a*	......	......	......	0.16	
Santa Cruz *b*†	95	36	57.4	0.52	
Santa Cruz L. H.	......	......	......	0.29	
Santa Maria	98	34	59.8	0.02	
Santa Monica *[1]	96	48	65.0	0.18	
Santa Paula	97	32	60.0	0.00	
Santa Rosa *[1]	84	35	59.0	0.38	
Saticoy	......	......	......	0.10	
Shasta	......	......	......	0.56	
Sierra Madre	96	37	63.1	0.90	
Sneddens Ranch *[1]	84	10	45.3	0.00	
S. E. Farallone L. H	......	......	......	0.12	
Stanford University	87	31	56.3	0.20	
Stockton *a*	91	38	61.3	T.	
Summerdale†	78	24	50.0	0.53	2.0
Susanville†	76	24	45.4	0.24	1.0
Tehama *[1]	94	47	65.2	0.25	
Templeton *[1]	98	40	57.8	0.00	
Trinidad L. H.	......	......	......	2.05	
Truckee *[1]	78	26	45.2	0.25	2.5
Tulare *c*	106	32	66.8	T.	
Turlock *[1]	94	49	66.3	0.08	
Ukiah	88	31	56.4	0.80	
Upperlake	93	32	57.8	0.43	
Upper Mattole	82	34	57.4	2.88	
Vacaville *a**[1]	79	40	63.1	0.52	
Ventura†	95	31	56.9	0.00	
Visalia	104	30	62.5	0.08	
Volcano Springs *[1]	118	49	84.3	0.00	
Walnut Creek	90	36	61.6	0.02	
West Palmdale *[1]	98	30	58.7	0.00	
Westpoint	......	......	......	0.82	1.5
Wheatland†	90	36	61.5	0.24	
Williams *[1]	91	46	66.1	0.20	
Wilmington *[5]	94	49	67.1	T.	
Wire Bridge *[5]	91	36	63.0	0.48	
Yerba Buena L. H	......	......	......	0.00	
Yreka†	85	22	51.8	0.48	
Colorado.					
Altman	67	4	34.6	1.78	18.8
Antlers†	81	21	50.7	1.05	
Arkins	......	......	......	1.42	......
Boulder	78	23	49.2	1.54	8.2
Boxelder	......	......	......	1.32	
Breckenridge†	69	−5	31.2	1.53	18.2
Canyon†	86	21	52.8	0.91	0.5
Castlerock	85	11	46.2	1.76	9.0
Cedaredge	80	19	49.6	1.10	
Cheyenne Wells	84	19	49.2	1.10	1.0
Collbran	......	......	......	0.72	
Colorado Springs†	76	20	46.6	1.54	2.8
Crook	89	19	49.5	1.03	1.5
Delta	90	17	53.7	0.58	
Dumont†	......	......	......	2.45	20.0
Durango	78	20	49.8	1.67	
Fleming	......	......	......	0.87	
Fort Collins†	86	14	47.6	0.69	1.0
Fox	......	......	......	3.18	12.0
Garnett	72	9	42.0	0.09	
Georgetown	70	11	42.2	......	
Glenevrie†	75	19	45.6	1.16	
Grand Junction†	84	29	56.8	0.92	
Gulch *f*	81	24	48.1		
Hamps	80	18	45.8	0.96	6.0
Hoehne	85	20	50.6	1.25	7.0
Holly	......	......	......	0.84	1.0
Holyoke	......	......	......	1.61	2.5
Holyoke (near)	89	19	49.6	2.03	1.5
Hugo	......	......	......	1.24	6.0
Husted†	80	15	46.6	1.77	8.0
Lake Moraine†	64	3	34.6	1.76	21.8
Lamar†	87	26	54.2	1.38	T.
Laporte	......	......	......	0.24	2.5
Las Animas†	84	22	54.6	1.17	
Leadville (near) *†[1]	58	10	32.0	1.88	23.5
Leroy†	84	20	48.2	1.04	1.5
Longs Peak	67	0	36.3	1.73	17.0
Meeker	80	15	45.0	0.79	
Millbrook	75	11	44.1	1.08	T.
Minneapolis†	87	21	54.0	1.92	2.0
Moraine†	70	0	40.7	1.44	7.0
Pagoda†	87	15	44.9	0.92	
Rangely†	81	20	49.6	0.02	
Redcliff	......	......	......	1.07	11.3
Rico	68	9	39.4	2.62	2.0
Rockyford	86	23	53.5	1.06	1.0
Ruby	......	......	......	1.83	18.0
Saguache†	73	15	45.8	0.73	0.3
Salida	80	19	46.4	0.15	T.
San Luis†	79	13	45.4		......
Santa Clara *[1]	72	12	43.4	2.60	18.0
Seguro	64	8	38.4		......
Seibert†	......	......	......	1.50	8.3
Smoky Hill Mine	75	7	42.3	3.36	21.0

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Colorado—Cont'd.	°	°	°	*Ins.*	*Ins.*
Springfield	......	......	......	2.10	10.0
Stamford *[1]	62	12	33.9	3.99	33.0
Steamboat Springs	76	0	40.8	0.63	1.0
Strickler Tunnel	......	......	......	1.23	18.2
T. S. Ranch†	80	24	53.0	0.65	
Vilas	......	......	......	2.05	
Wagon Wheel	65	5	36.7	1.95	20.0
Walden	74	3	39.1	2.37	10.1
Wallet	......	......	......	1.75	6.0
Wray†	87	19	50.8	1.73	1.0
Yuma	......	......	......	1.55	10.0
Connecticut.					
Canton†	72	14	42.8	3.72	2.0
Colchester	71	18	44.4	5.41	4.0
Falls Village	......	......	......	4.35	7.2
Greenfield Hill	......	......	......	4.29	3.1
Hartford *a*	72	22	45.2	4.36	2.0
Hartford *b*	......	......	......	4.06	2.0
Hawleyville	73	23	47.2	3.90	3.0
Lake Konomoc	......	......	......	5.72	......
Middletown	74	19	46.0	5.41	3.5
New London†	68	21	41.5	4.49	3.5
North Grosvenor Dale	78	18	44.4	4.34	2.0
Norwalk	73	13	43.8	3.74	3.0
Pomfret	69	23	43.7	6.46	......
Southington	71	18	44.8	3.23	1.5
South Manchester	......	......	......	4.05	4.0
Storrs	70	16	42.2	4.44	4.6
Voluntown†	71	15	44.4	5.93	3.0
Waterbury	73	20	44.6	3.67	1.0
West Cornwall†	67	15	41.6	4.31	8.8
West Simsbury	......	......	......	3.69	3.0
Winsted *[1]	68	22	40.8	......	......
Delaware.					
Dover	81	23	50.0	4.27	T.
Milford	81	26	52.4	2.65	2.0
Millsboro	82	23	49.3	4.42	T.
Newark	76	21	48.2	2.76	3.0
Seaford	81	26	50.6	3.91	T.
District of Columbia.					
Distributing Reservoir *[5]	80	29	51.6	......	......
Receiving Reservoir *[5]	80	27	50.6	......	......
West Washington	87	24	51.0	2.65	T.
Florida.					
Archer†	90	40	68.8	2.38	
Bartow	93	40	70.7	0.36	
Boca Raton†	87	50	72.2	1.80	
Brooksville†	94	44	69.2	0.34	
Carrabelle†	81	41	65.3	1.20	
Clermont†	93	47	70.8	0.49	
De Funiak Springs	86	34	61.3	1.65	
Earnestville	94	44	70.8	0.65	
Eustis†	92	41	69.8	0.47	
Federal Point†	88	39	66.4	7.45	
Fort Meade	93*	40	70.0*	0.57	
Frostproof	95	45	72.4	0.58	
Gainesville	88	42	66.6	2.85	
Grasmere†	92	44	69.2	0.51	
Haywood	85	41	66.0	3.52	
Homeland	71	45	68.4	......	
Huntington	89	44	68.0	1.33	
Jasper	89	34	64.4	1.85	
Kissimmee	92	43	71.2	0.12	
Lake Butler	......	......	......	1.52	
Lake City†	89	36	66.4	1.94	
Lemon City	92	52	72.2	0.60	
Macclenny†	91	37	66.1	1.74	
Manatee	92	43	69.0	0.25	
Merritts Island	89	52	70.2	0.51	
Myers†	90	51	69.7	0.37	
New Smyrna	92	45	67.6	1.19	
Ocala†	92	39	67.6	2.54	
Orange City	91	42	69.0	0.65	
Orange Park	86	39	66.6	3.17	
Orlando†	91	48	69.8	0.15	
Plant City	91	40	69.0	0.32	
St. Andrews	82	40	65.6	0.76	
St. Francis†	90	36	65.6	1.70	
St. Francis Barracks	86	45	65.2	4.20	
Sebastian	92	49	70.6	1.45	
Switzerland *[1]	85	43	64.9	1.87	
Tallahassee†	88	38	65.0	0.87	
Tarpon Springs†	87	45	68.8	0.30	
Wausau	87	34	63.8	2.88	
Georgia.					
Adairsville†	81	31	54.8	5.87	
Albany†	87	35	63.2	3.91	
Allentown†	86	32	60.4	7.22	
Americus†	87	34	61.4	6.72	
Athens *b*†	81	32	56.1	5.58	
Bellville	88	31	60.7	3.66	
Blakely†	83	36	63.2	3.09	
Brag	88	31	62.0	5.19	
Canton†	......	......	......	5.22	
Cartersville	......	......	......	4.54	
Cedartown	81[4]	29[4]	54.7[4]	4.17	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Georgia—Cont'd.	°	°	°	*Ins.*	*Ins.*
Clayton†	81	28	53.0	5.82	T.
Columbus	86	34	59.3	3.87	
Covington	77	31	55.3	5.93	
Crescent	85	32	63.6	2.58	
Dahlonega†	81	29	53.6	5.53	
Diamond	80	25	50.7	6.27	
Elberton†	84	31	57.4	5.35	
Fitzgerald	88	33	62.6	......	
Fleming†	88	......	......	3.34	
Fort Gaines	84	34	61.8	3.34	
Franklin	80	33	57.4	5.66	
Gainesville	78	32	53.4	5.23	
Gillsville†	82	28	56.3	4.20	
Greenbush	80	29	55.3	5.29	
Hephzibah	......	......	......	3.40	
Jesup	88	30	61.6	2.41	
Lagrange†	85	33	59.0	4.90	
Lawrenceville	......	......	......	5.38	
Leverett	87	29	56.6	4.38	
Louisville	85	35	60.2	6.64	
Marietta	80	31	55.1	3.92	
Marshallville†	82	36	61.0	9.12	
Morgan†	88	31	60.2	3.97	
Newnan	81	32	55.4	5.22	
Piscola	89	37	65.6	2.45	
Point Peter	83	27	53.5	5.38	
Poulan†	89	32	66.8	3.15	
Quitman†	88	32	62.8	3.03	
Ramsey	81	28	54.8	4.56	
Resaca	......	......	......	5.11	
Reynolds	......	......	......	6.27	
Rome†	......	......	......	6.62	
Talbotton†	81	35	58.8	4.93	
Tallapoosa	80	29	54.6	6.32	
Thomasville†	86	36	63.6	4.22	
Toccoa†	83	29	57.4	5.08	
Washington†	......	......	......	4.84	
Waycross	86	35	62.2	2.17	
Idaho.					
Albany Falls	75	23	46.9	1.31	
American Falls	82	20	48.8	0.15	
Blackfoot†	81	21	49.0	......	
Burnside†	74	19	43.2	0.10	
Challis	80	18	50.6	0.73	
Chesterfield	74	18	43.8	......	
Corral *[1]	77	17	43.4	0.56	0.5
Downey	79	19	47.0	1.07	0.2
Fort Sherman†	78	24	47.4	1.25	
Gimlet†	......	......	......	0.61	1.5
Gray	72	10	39.4	0.20	2.0
Kootenai†	78	24	51.5	0.63	
Lake	66	10	33.0	0.35	3.5
Lakeview	75	29	46.6	1.38	
Lewiston	82	53	54.6	0.65	
Marysville	76	10	39.6	0.47	4.0
Minidoka	......	......	......	0.10	
Moscow	75	27	45.6	1.02	
Murray†	78	22	44.8	2.13	T.
Nampa	92	20	53.2	0.30	T.
New Plymouth	90	25	56.8	0.26	
Oakley	80	19	50.3	0.20	
Ola†	90	25	52.3	0.94	
Paris	77	4	41.4	0.76	
Payette†	94	30	61.3	0.51	
Pollock†	90	28	53.6	0.81	
Rexburg	78	10[4]	48.2	0.02	
St. Maries	80	27	49.5	1.45	
Salubria	88	25	53.1	0.64	T.
Soldier†	79	10	44.2	0.33	0.5
Swan Valley†	76	10	43.4	0.48	3.0
Warren†	72	9	41.2	0.81	
Weston	80	24	50.4	1.34	
Yellow Jacket	......	......	......	0.43	
Illinois.					
Albion†	80	26	49.2	5.27	
Alexander†	82	23	50.9	3.15	
Ashton *†[1]	78	24	47.2	2.48	T.
Atwood *a**[3]	74	20	45.4	3.77	
Atwood *b*	......	......	......	2.95	
Aurora *a*	78	21	47.0	1.30	......
Aurora *b*	79	21	46.9	1.49	0.1
Beardstown	......	......	......	2.51	
Bloomington†	87	20	50.4	2.66	
Cambridge	78	22	48.4	2.89	
Carlinville†	82	24	52.0	4.30	T.
Carlyle	......	......	......	3.91	
Carrollton	79	23	50.6	5.16	T.
Chemung	79	20	44.4	2.20	T.
Chester	......	......	......	3.48	
Cisne†	78	27	53.3	5.01	
Coatsburg	80	22	50.0	4.83	
Cobden†	80	27	53.7	4.28	
Danville	85	20	50.2	2.47	
Decatur†	81	20	50.1	3.36	
Dixon†	82	23	47.6	3.29	
Dwight†	77	21	48.2	2.95	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Illinois—Cont'd.	°	°	°	*Ins.*	*Ins.*
East Peoria†	84	21	48.8	2.80	
Effingham†	80	25	51.9	4.87	
Elgin	79	21	46.4	1.40	T.
Equality	82	30	53.8	4.50	
Fort Sheridan†	79	22	43.2	1.35	
Friendgrove†	......	......	......	5.46	
Galva†	80	21	48.0	2.77	T.
Glenwood				1.51	
Golconda†	86	29	53.8	4.03	
Grafton†				3.18	
Greenville†	80	24	51.9	3.58	
Griggsville†	83	24	51.4	4.95	T.
Halliday*[5]	80	30	56.2	3.69	
Havana†	81	27	22.0	2.90	T.
Hillsboro†	80	24	51.8	3.80	T.
Joliet†	76	23	47.9	1.42	T.
Kankakee *a*	79	22	48.0	1.31	
Kishwaukee	75	19	44.6	3.38	T.
Knoxville *a*	80	21	48.0	3.85	
Lagrange†	78	21	45.5	1.14	T.
Laharpe	80	24	50.7	3.91	
Lanark†	81	17	46.0	2.76	T.
Lexington	80	21	48.6	2.13	
Loami†	......	......	......	3.58	
McLeansboro†	80	28	52.6	5.38	
Martinton†	82	19	47.4	1.98	
Mascoutah	84	28	51.8	4.21	
Mattoon	81	24	51.0	4.01	
Minonk†	80	21	47.6	2.87	T.
Monmouth†	81	21	49.2	2.73	
Morrisonville†	78	22	50.2	2.92	
Mount Carmel†				4.42	
Mount Pulaski	83	23	51.6	2.47	T.
Mount Vernon	78[e]	30	50.2	3.54	
New Burnside†	81	27	53.7	3.76	
Ottawa†	79	22	48.4	3.12	T.
Palestine†	79	24	49.6	3.82	
Paris	79	22	50.0	2.41	
Peoria *a*†	......	......	......	3.17	0.1
Peoria *b*†	83	24	50.0	3.02	T.
Philo†	81	21	48.8	2.84	
Plumhill†				3.90	
Rantoul†	82	20	48.9	2.04	
Reynolds	81	21	48.6	2.89	
Riley†	79	20	46.0	1.90	T.
Rockford	80	23	46.2	2.16	T.
Roundgrove†	83	22	48.8	5.11	
St. Charles*†[1]	75	24	45.5	1.03	0.4
St. John†	......	......	......	3.53	
Scales Mound	81	15	45.4	2.78	
Streator†	79	23	50.6	3.00	T.
Sycamore†	78	21	47.1	1.65	
Tilden	81	28	53.1	3.40	
Tiskilwa†	78	21	47.5	3.50	T.
Tuscola†	81	20	49.0	3.74	
Walnut†	81	23	49.2	2.78	
Wheaton*[3]		22	43.0	1.31	0.5
Winchester*[1]	80	24	49.3	3.87	
Winnebago†	80	22	46.1	3.39	
Zion†	81	20	47.2	3.07	
Indiana.					
Anderson†	77	19	49.0	2.49	
Angola				0.85	
Auburn	80	17	43.6	1.63	
Bedford				0.50	
Bloomington†	......	......	......	1.88	
Bluffton†	80	17	48.4	2.86	T.
Boonville	80	27	53.4	3.08	
Butlerville†	78	20	50.0	2.02	1.2
Cambridge City†	77	20	47.4	1.67	T.
Columbia City*[1]	78	20	46.1	1.64	
Columbus†	78	20	49.0	1.50	
Connersville†	75	19	48.6	1.41	T.
Delphi†	82	19	48.0	2.07	T.
Edwardsville*†[1]	77	25	52.7	3.00	1.0
Farmland†	78	18	48.1	3.68	
Fort Wayne	82	17	47.6	2.08	
Franklin*[1]	80	24	51.0	0.84	
Greencastle†	76	20	49.6	2.15	
Greensburg	76	20	51.5	1.15	T.
Hammond†	78	19	44.8	......	
Hector	79	18	47.3	2.66	
Huntington	81	15	48.2	2.85	
Jasper†	79	25	52.0	3.10	
Jeffersonville	80	26	52.2	2.97	2.0
Knightstown†	79	20	49.7	1.72	T.
Knox				1.30	
Kokomo†	82	19	50.8	2.97	
Lafayette†	78	18	48.1	2.13	
Laporte	77	17	46.2	1.12	
Logansport *b*†	80	19	48.5	2.39	
Madison	80	22	51.4	1.42	0.2
Marengo†	79	24	51.4	......	......
Marion†	80	18	48.4	2.59	
Markle	79	31	50.0	2.20	
Mauzy†	77	24	48.4	1.33	T.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Indiana—Cont'd.	°	°	°	*Ins.*	*Ins.*
Michigan City*[10]	74	21	43.0	......	......
Mount Vernon†	79	28	53.0	4.16	
Northfield†	77	18	48.0	2.34	
Paoli	82	21	51.4	2.09	0.8
Princeton*[1]	84	28	52.8	2.90	
Richmond	78	20	48.9	1.78	
Rockport	80	28	54.4	4.04	
Rockville†	80	21	50.2	2.59	
Salem	72	20	49.1	0.83	......
Scottsburg	81	25	51.2	1.96	2.5
Seymour	76	20	50.8	1.72	0.2
Shelbyville	77	22	50.8	1.53	
South Bend†	77	16	46.9	1.01	
Syracuse†	......	......	......	1.16	
Terre Haute†	80	25	52.0	2.72	
Topeka†	75	16	46.5	1.11	
Valparaiso†	76	16	45.9	1.01	
Vevay	85	24	53.6	0.97	0.2
Vincennes	82	20	50.4	3.85	
Warsaw	......	......	......	1.43	T.
Washington†	......	......	......	2.46	T.
Winamac	81	11	49.1	1.82	
Worthington†	80	23	51.4	1.98	
Indian Territory.					
Healdton†	89	32	61.0	1.80	
Lehigh†	88	30	60.2	3.00	
Purcell	89	25	61.2	1.20	
South McAlester†	......	......	......	2.55	
Tahlequah	82	26	56.0	1.71	
Tulsa†	......	......	......	1.65	
Wagoner	86	27	57.6	3.64	
Iowa.					
Adair	......	......	......	1.35	
Afton	86	22	50.1	2.38	
Algona*[1]	76	23	47.2	2.42	
Alta *a*†	82	20	47.2	3.02	
Amana†	84	20	48.2	3.24	
Ames *b*	90	22	49.2	1.52	
Ames (near)	......	......	......	0.92	
Atlantic†	88	19	46.7	2.42	
Audubon	86	21	47.8	0.83	
Belknap	80	23	50.2	2.95	
Belleplaine	......	......	......	3.89	
Bonaparte†	82	22	49.4	3.71	
Britt	79	18	45.4	2.79	
Burlington	82	23	51.4	2.79	
Carroll	91	20	48.8	1.73	
Cedarfalls	87	20	48.4	2.15	
Cedar Rapids†	87	21	48.8	2.47	
Centerville	81	25	49.8	2.33	
Chariton	82	24	50.0	2.20	
Charles City	78	19	45.4	1.72	
Clarinda†	86	26	51.8	3.70	
Clear Lake	77	21	46.4	2.46	
Clinton	83	23	48.4	3.53	
College Springs	87	25	50.8	2.56	
Corning†	87	22	50.4	1.68	
Council Bluffs	90	24	51.6	2.85	
Cresco†	79	18	44.8	2.80	
Decorah†	80	18	45.7	2.81	
Delaware*[3]	86	20	44.6	2.37	
Denison†	84	20	47.2	3.25	
Desoto	89	24	49.2	1.86	
Dows	83	20	47.2	1.88	
Eldon	84	20	50.0	2.83	
Eldora	90	18	45.0	2.40	
Elkader†	84	17	46.1	2.64	
Estherville	76	17	44.8	1.38	1.0
Fairfield†	81	21	48.6	3.22	
Fayette†	81	16	44.7	3.85	
Forest City	78	20	45.4	2.50	
Fort Madison*†[1]	81	26	53.2	4.25	
Fredericksburg	......	......	......	2.05	
Galva	88	20	48.4	1.90	
Garden Grove	85	21	48.8	2.31	
Glenwood†	91	24	51.0	2.97	
Grand Meadow*[1]	76	18	44.6	2.78	
Greene	84	20[e]	46.7[e]	1.52	
Greenfield	89	20	48.8	1.97	
Grinnell	83	18	48.4	4.31	
Grundy Center	88	19	46.8	1.94	
Guthrie Center	89	19	49.1	0.78	
Hampton	83	20	47.1	2.29	
Hawkeye	......	......	......	2.20	
Hedrick	86	27	52.2	3.21	
Hopeville†	86	22	49.0	2.22	
Humboldt†	82	20	47.6	1.58	
Independence†	84	16	46.0	1.85	
Indianola†	87	20	50.2	4.71	
Iowa City *a*	82	21	48.4	2.89	
Iowa Falls†	86	18	46.5	1.84	
Knoxville	86	22	50.0	2.18	
Lamoni	85	25	49.4	1.95	
Lansing	81	19	47.0	3.03	
Larchwood	......	......	......	0.27	T.
Larrabee†	86	16	46.5	1.82	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Iowa—Cont'd.	°	°	°	*Ins.*	*Ins.*
Leclaire	......	......	......	3.28	
Lemars	84	17	48.6	1.96	
Lenox	86	23	49.6	2.89	
Logan†	91	20	47.8	2.82	
Maple Valley	......	......	......	2.35	
Maquoketa	82	23	48.0	3.20	
Marshall†	90	19	47.6	1.87	
Mason City	77	20	45.7	1.85	
Millman	......	......	......	2.48	
Monticello	83[d]	19[d]	46.7[d]	2.40	
Mooar	83	18	48.8	4.82	
Mountayr	87	24	49.7	2.45	
Mount Pleasant*[1]	74	26	51.2	4.02	
Mount Vernon *a**[1]	81	20	48.8	2.68	
Mount Vernon *b*	83	19	47.4	3.02	
New Hampton	87	20	50.7	2.04	
Newton†	87	22	49.4	2.23	
North McGregor	......	......	......	2.97	
Northwood	78	21[e]	44.4	2.49	
Odebolt	90	20	48.6	2.15	
Ogden	91	21	48.6	1.46	
Olin	81	19	46.0	2.32	
Osage*[3]	......	25	43.8	3.02	
Osceola	87	22	48.8	1.44	
Oskaloosa†	84	19	48.4	......	
Ottumwa	84	22	49.6	2.65	
Ovid†	75	23	48.8	2.84	
Plover	82	20	48.5	1.75	
Portsmouth[j]	91	16	45.2	2.92	
Primghar	82	18	47.7	2.19	
Red Oak	88	23	49.8	2.69	
Ridgway	85	18	46.4	3.09	
Rock Rapids	84	14	46.3	1.45	T.
Rockwell City	82	20	46.0	2.23	
Ruthven	81	19	47.4	3.01	
Sac City†	88	20	46.6	2.40	
Sibley	86	15	46.0	1.44	
Sidney	85	27	50.6	4.49	
Spencer	74	18	45.4	3.12	T.
Spirit Lake†	84	18	46.5	2.34	1.0
Stuart	85	28	47.8	1.75	
Tara	86	18	47.8	1.70	
Thurman	86	20	50.5	3.79	
Toledo	86	17	47.7	2.27	
Villisca†	88	21	49.4	3.05	
Vinton*[1]	85	22	47.1	2.53	
Washington	84	18	48.2	2.83	
Washta	......	......	......	1.61	
Waterloo	86	19	47.0	2.09	
Waverly	84	21	47.2	2.03	
Webster City	82	24	47.8	1.21	
Westbend*†[1]	78	21	45.2	2.49	
West Branch	82	20	48.1	3.08	
Whitten*[1]	85	24	46.4	1.73	
Wilton Junction†	82	20	48.2	3.38	
Winterset†	88	20	49.8	2.88	
Kansas.					
Abilene†	87	24	53.6	3.81	
Achilles	......	......	......	1.88	
Altoona	......	......	......	3.51	
Anthony	......	......	......	1.28	
Assaria*[5]	88	26	54.1	3.95	
Atchison†	88	27	55.4	3.24	
Augusta	86	20	54.4	3.34	
Baker	86	13	50.4	3.81	
Beloit†	87	19	52.1	1.91	
Burlington†	88	28	54.0	4.01	
Campbell	90	24	52.4	8.11	T.
Chanute	85[d]	31[d]	53.2[d]	3.48	
Colby†	84	14	52.0	1.11	1.5
Columbus	84	25	54.4	2.88	
Coolidge†	87	19	54.0	0.70	
Cunningham†	90	19	54.6	4.52	
Delphos	88	20	53.6	1.63	
Dresden	93	23	52.6	2.05	0.2
Ellinwood†	87	14	54.0	2.58	T.
Emporia	83	29	54.6	5.40	
Englewood†	89	21	58.0	1.39	
Eskridge	86	27	51.5	4.59	
Eureka	......	......	......	5.17	
Eureka Ranch†	89	10	53.0	1.22	
Fallriver	87	26	55.4	2.79	
Fanning	......	23	......	3.09	
Fort Riley†	87	22	54.6	4.85	
Fort Scott†	83	28	53.2	4.67	
Frankfort	88	24	52.8	4.95	T.
Garden City†	90	16	55.2	0.97	
Garfield	......	......	......	4.72	
Gibson	91	11	52.3	0.98	
Gove	......	......	......	1.66	
Grenola	90	23	54.3	2.26	
Halstead	90	20	52.4	5.23	
Hays	87	12	51.3	2.38	
Horton	88	26	52.2	3.14	T.
Hoxie	88	10	50.9	1.99	T.
Hutchinson	87	24	55.2	6.40	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Kansas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Independence	87	28	56.2	2.67	
Lawrence	84	30	54.0	5.41	
Lebanon	89	15	53.0	1.10	
Lebo †	87	29	53.2	4.79	T.
Macksville	84	17	53.0	3.84	
McPherson	88	23	53.8	6.16	
Manhattan *b*	90	25	54.2	4.49	
Manhattan *c*	89	24	53.6	4.74	
Marion †	85	25	55.4	7.10	
Meade †	92	23	58.0	0.80	
Medicine Lodge †	88	21	56.7	2.43	
Minneapolis †	87	22	52.4	1.97	
Morantown †	80	28	52.2	3.84	
Morland	90	10	52.3	2.52	T.
Mounthope *[1]	86	27	54.7	4.63	
Ness City	87	28	55.6	1.38	
Newton	86	22	54.4	4.52	
Norton	85	12[h]	50.0[f]	3.62	
Norwich	87	25	55.2	6.27	
Oberlin	......	......	......	2.18	
Olathe †	84	26	52.4	3.52	
Osage City †	87	26	52.8	4.36	
Osborne	......	......	......	1.29	
Oswego	88	30	56.8	3.50	
Ottawa	87	24	52.5	3.93	
Phillipsburg	88	12	49.8	3.26	
Pratt	......	......	......	7.20	
Rome *†[1]	86	23	55.0	3.06	
Russell	88	14	54.2	2.03	
Salina †	90	20	53.4	3.48	
Sedan †	86	26	54.8	1.40	
Seneca	88	23	51.9	3.06	T.
Sharon Springs *[1]	92	24	52.5	......	......
Toronto	86	25	53.0	2.96	
Ulysses	87[e]	15[e]	53.5[e]	0.25	T.
Viroqua †	88	24	56.2	1.28	0.5
Wallace	......	......	......	0.75	T.
Wamego *[1]	88	26	52.6	5.06	
Wellington	82	31	57.0	3.75	
Yates Center	87	24	53.5	3.46	T.
Kentucky.					
Alpha *[3]	82	24	51.2	5.11	T.
Ashland	80	19	50.8	......	......
Bardstown †	80	24	50.8	3.21	
Blandville †	80	30	53.9	4.13	
Bowling Green *b* †	83	28	53.4	4.08	
Burnside †	......	......	......	3.41	T.
Caddo	80	22	49.4	2.93	3.5
Canton *†[1]	84	34	56.1	4.83	
Carrollton †	82	24	53.4	1.08	2.0
Catlettsburg	......	......	......	2.19	4.0
Earlington	78	30	52.5	4.80	
Edmonton †	77	26	51.7	3.21	T.
Ensor	80	27	54.4	3.88	
Eubank	82	20	49.6	3.73	
Falmouth †	......	......	......	2.53	3.0
Fords Ferry	82	30	53.3	4.94	
Frankfort	85[e]	23[e]	51.3[e]	2.69	......
Georgetown	78	23	50.6	......	
Greensburg †	85	23	51.0	3.21	0.2
Henderson †	82	30	55.7	5.55	
Hopkinsville †	83	28	54.6	4.19	
Irvington	80	24	52.2	2.86	0.1
Leitchfield †	79	25	50.9	4.25	0.8
Loretto	81	21	51.6	3.88	1.4
Lyndon	78	24	52.0	......	
Maysville	85	20	51.3	1.99	3.8
Middlesboro †	82	22	50.2	3.38	T.
Mount Hermon	79	24	52.0	4.11	
Mount Sterling †	78	21	50.1	2.69	......
Owensboro †	81	29	52.1	4.17	
Owenton †	77	20	51.0	2.25	
Paducah *a* †	......	......	......	3.66	
Paducah *b* †	86	32	56.5	3.85	
Princeton	85	28	53.8	5.15	
Richmond †	81	22	50.9	3.18	2.0
Russellville †	82	28	55.8	3.23	
St. John †	79	25	51.0	4.20	1.7
Scott	76	22	50.6	1.43	1.0
Shelby City	83	20	51.4	3.62	2.0
Shelbyville †	84	23	51.6	2.58	2.5
Southfork [5]	......	......	50.0	......	
Vanceburg	78	20	48.0	2.50	4.0
Williamsburg †	82	24	51.9	3.70	
Woodburn *[1]	80	26	54.1	3.60	T.
Louisiana.					
Abbeville	83	38	63.4	3.85	
Alexandria †	86	32	62.0	2.03	
Amite †	85	35	62.0	3.48	
Bastrop †	85	29	62.1	5.67	
Baton Rouge †	86	38	63.7	3.11	
Calhoun	83	32	60.8	4.62	
Cheneyville †	85	37	62.7	1.92	
Clinton †	83	35	62.6	3.81	
Como	89	35	61.9	2.64	
Covington	87	43	67.4	2.39	
Louisiana—Cont'd.					
Donaldsonville	88	40	64.9	3.40	
Emilie	82	38	63.0	3.90	
Elm Hall	82	38	65.3	2.72	
Farmerville	86	32	60.9	3.15	
Franklin †	84	40	63.6	1.23	
Grand Coteau	83	41	65.1	2.80	
Houma	85	37	64.9	2.32	
Jeanerette	89	37	64.8	1.63	
Jennings	85	38	64.1	4.23	
Lafayette	85	40	63.0	3.67	
Lake Charles †	85	42	64.6	3.49	
Lawrence	83	40	65.6	1.83	
Liberty Hill	89	31	61.9	4.40	
Mansfield	85	32	60.1	2.90	
Melville	82	40	63.7	4.70	
Minden	85	36	60.5	2.40	
Monroe †	87	34	62.1	2.99	
Montgomery	86	33	62.0	1.37	
New Iberia	81	42	62.4	3.00	
Opelousas	84	36	62.3	3.60	
Oxford	84	32	60.3	4.29	
Paincourtville †	87	38	65.0	1.70	
Plain Dealing †	85	32	59.8	1.70	
Plaquemine	88	40	65.8	2.40	
Rayne	86	38	64.0	3.93	
Robeline	85	28	60.2	3.21	
Ruston	82	34	61.2	3.58	
Schriever	87	37	63.4	2.32	
Shellbeach	83	43	65.5	2.63	
Southern University †	82	37	62.0	2.75	
Sugar Ex. Station †	82	40	63.6	3.45	
Venice †	79	46	63.8	0.80	
Wallace	82	40	63.9	3.40	
Whitehall	88	36	63.9	2.86	
White Sulphur Springs	89	32	63.6	3.44	
Maine.					
Bar Harbor	67	13	40.7	4.85	6.0
Belfast *[6]	63	23	41.5	4.67	9.0
Calais	63	12	39.1	4.56	16.5
Cornish *[1]	66	16	40.8	4.63	11.0
Cumberland Mills	73	14	42.6	3.81	......
Fairfield	65	13	41.6	2.31	3.0
Farmington	68	7	40.6	2.71	7.5
Flagstaff	......	......	......	1.76	4.0
Gardiner	69	13	42.2	3.44	5.5
Kineo †	60	6	37.5	2.22	6.0
Lewiston	66	18	42.2	3.48	6.2
Mayfield *[1]	60	5	36.8	2.26	4.0
North Bridgton	70	12	41.6	3.53	6.6
Orono	65	9	39.8	4.95	9.0
Petit Menan *[1]	47	20	36.4	......	......
Winslow	67	12	41.6	2.44	3.0
Maryland.					
Annapolis	80	24	52.8	1.11	2.8
Bachmans Valley	77[e]	17[e]	46.2[e]	4.87	4.5
Boettcherville	80	20	46.8	2.55	4.0
Charlotte Hall †	86	25	51.2	3.42	......
Cherryfields †[2]	......	......	50.3	3.48	T.
Chestertown	75	25	49.2	2.77	2.0
Collegepark	83	24	51.6	2.24	......
Cumberland *b*	81	30	52.6	2.45	4.0
Darlington †	76	20	49.3	2.73	2.5
Deerpark	73	6	40.8	4.25	7.0
Denton	80	25	49.2	3.04	1.5
Easton †	81	26	49.2	2.76	1.0
Ellicott City	80	21	50.5	2.90	T.
Fallston	76	19	48.8	2.52	1.8
Frederick	79	25	49.6	1.53	2.0
Grantsville	74	12	42.0	3.42	7.0
Greenspring Furnace	80	17	49.2	1.34	T.
Hagerstown †	80	20	50.0	0.57	0.2
Jewell †	82	23	50.8	3.51	......
Johns Hopkins Hospital	81	23	50.0	2.32	......
Laurel	80	23	50.0	2.07	......
McDonough [h]	73	30	52.0	......	......
Mardela Springs †	78	24	49.7	3.08	0.2
Mount St. Marys Coll. †	77	21	48.9	1.43	1.2
New Market	79	21	51.1	2.59	0.8
Ocean City	88	25	49.2	5.07	
Pocomoke City	80	27	53.5	4.28	
Port Deposit	77	23	49.0	2.77	5.0
Princess Anne	80	25	50.5	3.40	T.
Sharpsburg	78	20	47.3	1.48	2.0
Smithsburg	79	19	48.0	0.63	1.0
Solomons †	82	28	51.8	3.68	2.0
Sunnyside	73	8	40.6	5.65	8.5
Taneytown †	83	20	51.0	1.89	1.5
Van Bibber	77	23	49.8	3.12	3.0
Westernport	79	19	48.0	3.32	4.0
Westminster	78	22	50.3	2.86	......
Woodstock	80	22	49.6	1.87	T.
Massachusetts.					
Adams	70	18	43.7	......	......
Amherst	70	16	43.2	3.79	3.5
Attleboro	......	......	......	6.75	......
Bedford	67	12	39.2	5.45	7.0
Massachusetts—Cont'd.					
Bluehill (summit)	71	18	40.9	5.99	6.0
Cambridge *a*	72	20	43.9	5.26	......
Chestnut Hill	72	19	43.4	6.17	5.0
Cohasset	......	......	......	8.47	1.0
Concord	71	16	41.5	4.48	5.8
Dudley [1]	64*	12	41.9	6.03	0.5
East Templeton *[1]	66	21	40.2	3.33	10.5
Fallriver	68	23	43.6	5.15	6.0
Fiskdale	......	......	......	2.89	6.0
Fitchburg *a* *[1]	68	21	41.2	5.37	5.5
Fitchburg *b*	71	17	41.8	4.39	5.5
Framingham	71	20	44.2	4.73	3.5
Groton	69	15	41.2	5.35	9.5
Hyannis *†[1]	61	21	42.2	5.78	4.5
Jefferson	......	......	......	4.10	6.0
Lawrence	72	19	43.2	4.93	3.5
Leeds	71	13	42.8	4.36	2.0
Leicester Hill	69	15	42.0	2.06	
Leominster	......	......	......	4.42	6.0
Long Plain	......	......	......	5.59	2.0
Lowell *a*	70	18	42.6	5.20	......
Lowell *b*	72	17	42.6	......	......
Lowell *c*	75	19	43.8	......	......
Ludlow	70	10	39.0	4.21	3.5
Lynn *a*	70	20	43.4	6.15	
Mansfield *[1]	70	17	43.2	6.96	5.0
Middleboro	71	15	42.2	5.41	3.8
Monson	70	15	43.4	3.94	4.5
Mount Nonotuck	......	......	......	4.14	8.0
New Bedford *a*	66	23	42.8	5.29	5.0
New Bedford *b*	69	22	43.4	5.36	2.5
New Salem	69	14	40.8	4.57	7.3
Pittsfield	68	12	41.2	3.59	1.0
Plymouth *[1]	70	26	44.8	5.82	0.5
Princeton	......	......	......	4.21	8.5
Provincetown	62	23	42.8	......	2.0
Salem	......	......	......	6.26	5.0
Somerset *[1]	71	22	45.7	5.68	6.0
South Clinton	......	......	......	4.81	3.8
Springfield Armory	71	14	42.2	3.46	2.8
Sterling	......	......	......	4.59	5.2
Taunton *b*	71	18	42.5	6.17	2.0
Taunton *c*	72	14	42.8	7.00	......
Turners Falls	69	19	43.4	3.25	......
Webster	......	......	......	3.78	3.0
Westboro †	71	17	42.3	4.34	4.5
Weston	70	18	42.3	5.41	5.1
Williamstown	66	13	41.5	3.60	T.
Winchendon	......	......	......	4.50	5.8
Worcester *b*	68	20	42.8	4.19	5.0
Michigan.					
Adrian	73	17	45.3	1.57	0.2
Agricultural College	73	15	43.6	2.12	1.5
Allegan	72	19	43.4	......	......
Alma	70	15	43.6	1.79	
Ann Arbor	72	15	45.2	1.57	0.5
Arbela	68	13	42.6	1.17	T.
Badaxe	66	21	42.0	2.21	
Baldwin	70	......	......	2.96	1.5
Ball Mountain	67	16	42.2	1.42	1.4
Battlecreek	74	16	45.4	0.99	
Bay City *b*	67	16	41.2	1.92	T.
Benton Harbor	63	16	43.4	2.40	
Berlin	68	14	42.2	1.52	0.6
Berrien Springs	77	16	44.0	1.38	
Big Rapids	68	13	42.1	2.20	
Birmingham	69	17	45.0	1.59	2.0
Bois Blanc *[10]	60	18	40.4	......	......
Boon	67[e]	6[d]	41.1[e]	2.75	6.6
Calumet	66	15	39.3	0.81	1.5
Camden	75	16	44.8	1.03	
Carsonville	66	16	41.2	1.21	T.
Charlevoix	67	16	40.2	1.48	1.5
Cheboygan	69	14	40.3	2.04	
Clinton	75	16	45.3	1.64	T.
Coldwater	74	14	45.2	1.17	
Crisps *[10]	68	12	38.4	......	......
East Tawas	65	11	41.4	1.64	T.
Eloise	72	16	44.9	1.41	T.
Escanaba †	61	12	39.4	2.51	3.0
Fairview	72	15	42.8	1.73	0.8
Fitchburg	72	14	43.1	2.08	1.0
Flint	68	17	42.6	1.70	
Gladwin	70	12	42.6	1.30	
Big Point Sable *[10]	60	18	39.7	......	......
Grand Rapids *b*	73	15	44.3	1.33	T.
Grape	76	16	46.0	1.50	0.5
Grayling	68	4	40.0	2.50	9.0
Hammonds Bay *[10]	66	12	37.6	......	......
Hanover	72	16	44.1	1.48	0.5
Harrisville	60	11	39.4	2.06	1.1
Hart	68	11	42.2	2.46	1.0
Hastings	75	11	44.2	1.54	2.5
Hayes	69	17	41.7	1.44	T.
Highland Station	......	......	......	1.88	3.0
Hillsdale	73	15	44.4	1.25	T.

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Michigan—Cont'd.	°	°	°	*Ins.*	*Ins.*
Holland *[10]	64	17	44.6	......	......
Howell	73	14	44.3	2.69	1.5
Humboldt	65	1	35.8	0.62	3.0
Ionia	74	17	44.0	1.36	T.
Iron River	65	4	37.4	2.34	8.0
Ivan	70	12	41.4	1.90	4.0
Jackson	74	16	45.4	1.24	T.
Jeddo	64	16	41.9	1.10	0.4
Kalamazoo	75	15	45.6	1.29	
Lake City	66	10	40.5	2.20	3.0
Lansing	71	16	43.7	1.81	2.2
Lapeer	71	14	42.3	0.97	
Lathrop	68	6	37.2	1.70	13.0
Ludington	65	20	41.4	2.59	T.
Luzerne	68	5	39.7	1.69	3.0
Mackinaw City	65	10	38.6	1.40	
Madison	75	16	46.0	1.43	0.6
Mancelona	67	11	40.2	1.49	5.8
Manistee	66	9	40.1	3.50	T.
Middle Island *[10]	55	15	38.1	......	......
Midland	69	18	43.0	......	......
Mottville	79	15	45.7	0.96	T.
Mount Clemens	76	16	44.5	1.50	1.0
Mount Pleasant *b*	71	13	42.2	1.83	
Muskallongee Lake *[10]	64	11	36.8	......	......
Muskegon	67	18	43.5	1.28	T.
Newberry	70	2	36.2	1.13	1.0
North Manitou Island *[10]	64	19	39.5	......	......
North Marshall	76	15	43.3	1.17	......
Northport	69	17	41.6	3.58	6.5
Old Mission	69	18	42.4	2.59	
Olivet	72	15	44.2	1.52	0.5
Omer	66	14	40.0	2.07	......
Ottawa Point *[10]	58	18	39.7	......	......
Ovid	70	16	43.4	1.52	
Owosso	72	16	43.9	1.62	
Parkville	......	......	......	1.41	
Pentwater *[10]	64	18	43.8	......	......
Petoskey	66	14	38.8	1.44	2.0
Plymouth	70	15	44.0	1.59	T.
Pointe aux Barques *[10]	60	18	40.4	......	......
Port Austin	62	18	40.6	2.00	
Powers	75	9	40.1	1.45	7.0
Reed City	69	10	40.8	2.65	......
Rockland	74	11	41.0	0.19	1.1
Rogers	67	4	38.6	1.25	1.0
Romeo	68	14	44.0	1.30	T.
Saginaw	69	16	43.0	1.65	0.2
St. Ignace	66	12	41.1	0.96	T.
St. Johns	70[b]	10	43.5[d]	1.50	
Sandbeach *a*	59	15	39.0	2.27	......
Sidnaw	68	−3	37.4	0.50	5.0
Somerset	72	15	44.6	1.07	1.0
South Haven	70	15	43.6	......	......
Sturgeon Point *[10]	62	3	37.1	......	......
Thornville	69	15	45.2	1.45	1.0
Thunder Bay Island *[10]	52	16	37.7	......	......
Traverse City	74	18	40.0	2.99	2.0
Two Heart River *[10]	70	12	37.6	......	......
Valley Center	70	14	42.0	1.10	0.6
Vandalia	78	17	48.0	1.63	
Vassar	69	16	42.3	1.23	T.
Vermillion Point *[10]	62	10	33.8	......	......
Wasepi	76	16	44.8	0.91	
Waverly	71	15	42.8	1.34	0.7
West Harrisville	65	13	40.4	1.67	0.5
Wetmore	66	4	36.6	1.23	10.0
White Cloud	69	12	42.8	2.25	0.7
Ypsilanti	69	14	44.6	2.07	T.
Minnesota.					
Ada†	76	14	45.2	1.48	
Albert Lea	75	21	45.0	3.36	T.
Alexandria†	77	18	44.2	0.81	
Beardsley	78	14	44.2	2.43	T.
Bingham Lake	81	15	44.0	6.29	2.0
Bird Island	80	18	44.7	1.05	2.3
Blooming Prairie†	75	19	43.4	2.20	0.5
Caledonia†	78	16	44.5	4.58	
Camden	80	14	45.8	1.42	T.
Campbell	72	13	41.1	0.24	
Collegeville	76	17	45.7	0.72	
Crookston†	70	16	43.2	0.74	
Deephaven	......	......	......	1.32	3.5
Detroit City	70	13	40.0	1.46	T.
Faribault	78	18	44.5	1.66	......
Farmington†	78	17	44.0	1.98	8.0
Fergus Falls†	73	17	44.0	1.02	T.
Glencoe	80	11	42.8	1.30	
Glenwood	77	13	44.6	1.68	......
Grand Meadow†	78	20	44.9	3.49	2.0
Granite Falls	82	16	43.3	0.84	
Koochicking	66	0	37.5	0.75	
Lake City	75	20	45.0	1.34	
Lake Jennie	82	17	46.0	3.75	
Lakeside†	78	20	45.0	1.96	1.5
Lake Winnibigoshish	69	10	39.2	1.00	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Minnesota—Cont'd.	°	°	°	*Ins.*	*Ins.*
Leech Lake	76	10	41.0	1.30	
Long Prairie	77	15	43.0	1.50	
Lutsen	63	9	36.3	0.10	
Luverne†	82	11	45.8	1.78	T.
Lynd	85	17	44.1	1.35	
Mapleplain	......	......	......	1.47	3.3
Milaca	76	14	42.0	......	......
Milan†	83	14	45.2	1.48	
Minneapolis *a*	76	16	44.2	1.49	1.0
Minneapolis *b*[1]	74*	16	43.4	1.77	3.0
Minnesota City *†[1]	78	20	47.4	2.98	
Montevideo†	87	15	46.8	1.31	T.
Morris	78	14	44.8	2.53	
Mount Iron	63	4	33.0		
Newfolden	76	14	40.2	0.89	
New London	76	14	43.2	2.50	T.
New Richland *[1]	72	22	43.9		
New Ulm†	83	21	45.1	0.46	2.0
Park Rapids†	70	13	39.4	0.96	......
Pine River	70	9	40.2	1.16	......
Pleasant Mounds	83	20	46.0	1.64	
Pokegama Falls	71	7	39.6	0.62	0.3
Redwing	......	......	......	1.38	
Reeds	......	......	......	1.68	
Rolling Green	77	18	44.2	1.90	T.
Roseau	65	10	39.0	0.94	
St. Charles†	76	19	44.6	2.85	2.0
St. Cloud	71	15	43.8	0.32	
St. Olaf	74	19	43.7	1.29	
St. Peter	77	......	......	1.49	1.0
Sandy Lake Dam	72	3	40.3	0.91	
Sauk Center	75	17	44.0	1.44	
Shakopee[6]	70*	19	47.0	1.02	1.0
Tower†	70	−9	30.6	0.80	T.
Two Harbors	65	15	39.3	0.77	0.5
Wabasha *[1]	75	22	45.5	1.92	T.
Willmar *	77	26	47.3	1.10	......
Willow River	73	10	43.3	0.66	1.0
Winnebago City	81	15	45.0	1.94	
Worthington	78	14	45.2	1.72	
Zumbrota[1]	74*	16	44.7	......	......
Mississippi.					
Agricultural College	82	31	58.6	4.58	
Austin†	85	30	59.0	3.48	
Batesville†	79	29	56.6	5.02	
Bay St. Louis	84	40	63.2	3.59	
Biloxi†	82	38	62.7	3.50	
Booneville	83	28	57.4	2.67	
Briers	80	38	61.0	2.76	
Brookhaven†	87	31	62.4	3.56	
Canton†	86	31	62.4	1.91	
Columbus *a*	......	......	......	3.90	
Corinth	78	31	56.4	3.40	
Crystal Springs†	87	32	60.9	2.03	
Edwards	85	33	61.1	3.29	
Fayette	85	34	61.8	2.75	
French Camps	84	25	56.6	4.33	
Greenville *a*	83	35	59.8	4.18	
Greenville *b*†	86	33	61.2	3.83	
Greenwood	......	31	......	4.78	
Hattiesburg†	84	35	63.4	2.10	
Holly Springs†	81	30	56.5	2.13	
Jackson†	83	33	59.5	2.88	
Kosciusko	83	31	60.6	2.48	
Lake†	88	32	57.2	3.36	
Leakesville	87	34	61.8	......	
Logtown†	83	42	64.2	2.20	
Louisville†	85	29	58.0	2.94	
Macon†	85	32	58.6	3.26	
Magnolia†	82	32	60.9	3.81	
Meridian	83	32	59.8	3.25	
Moss Point	81	41	61.0	1.35	
Natchez†	85	36	63.4	3.15	
Okolona†	84	31	57.6	3.96	
Palo Alto	79	29	57.5	3.45	
Pontotoc	83	27	57.5	3.64	
Port Gibson†	85	31	60.6	2.86	
Ripley	82	27	56.7	3.38	
Rosedale	84	31	59.8	1.58	
Stonington *[1]	80	36	61.5	......	
Thornton	82	32	62.0	4.42	
Tupelo†	......	......	......	3.19	
University	82[c]	27[c]	57.6[c]	4.27	
Walnut Grove	85	40	62.9	2.42	
Water Valley *†[1]	89	28	57.2	5.22	
Waynesboro	84	30	60.7	3.72	
Windham	91	31	61.4	5.14	
Woodville†	......	35	......	2.23	
Yazoo City†	88	32	60.6	3.60	
Missouri.					
Akron	......	......	......	2.60	
Arlington	......	......	......	4.42	
Arthur *[3]	......	28	52.0	5.13	
Avalon	82	26	51.6	2.89	
Bagnell	......	......	......	4.56	
Bethany	84	23	50.8	3.94	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Missouri—Cont'd.	°	°	°	*Ins.*	*Ins.*
Birchtree	82	22	52.6	3.69	
Bolckow	......	......	......	2.63	
Boonville†	......	......	......	3.41	
Brunswick	82	25	51.1	3.10	
Carrollton†	82	28	52.8	3.00	
Conception	84	25	50.7	2.69	
Cowgill *[5]	84	26	51.3	4.54	
Downing	......	......	......	4.27	
East Lynne *[3]	......	27	49.4	3.33	
Edgehill *[5]	78	26	51.6	3.01	
Eightmile *[1]	78	29	51.7	2.90	
Eldon	83	21	52.2	3.43	
Elmira	74	24	50.8	3.19	
Fairport	......	......	......	4.20	
Farmersville	......	......	......	2.89	
Fayette	86	25	54.4	2.84	
Fulton	......	......	......	3.49	
Gallatin *[1]	85	28	52.6	3.63	
Glasgow	84	24	52.7	2.83	
Gordonville *[3]	......	31	51.4	4.55	
Gorin	......	......	......	3.85	
Halfway	83	22	52.7	3.62	
Harrisonville†	85	25	51.3	2.76	
Hermann†	......	......	......	3.22	
Houston	82	21	53.2	3.11	
Houstonia	......	......	......	3.38	
Humansville	85	22	53.7	5.14	
Irena	......	......	......	2.78	
Ironton†	84	21	52.4	3.45	T.
Jefferson City†	89	25	53.7	3.94	
Kidder	83	25	50.8	3.89	
Lamar†	86	25	54.6	5.42	
Lamonte	......	......	......	4.55	
Lebanon	82	24	53.4	4.53	
Lexington	84	28	53.8	3.53	
Liberty	80	26	51.9	4.16	
Louisiana	84	24	52.1	4.38	
McCune *†[1]	82	27	50.7	4.77	
Malden [f]	90	29	58.9	......	
Marblehill	80	26	52.6	2.74	
Marshall†	81	23	51.4	3.10	
Maryville	88	23	49.9	2.51	T.
Mexico†	83	25	52.4	4.32	
Mineralspring	83	20	53.2	3.72	
Montreal	82	20	51.6	4.05	
Mount Vernon	86	28	54.6	2.17	
Neosho	84	23	54.6	2.97	
Nevada	85	25	53.9	3.97	
New Haven *[1]	80	30	55.1	4.06	
New Madrid	81	32	56.6	3.15	
New Palestine	86	26	57.7	4.26	
Oakfield	83	27	54.2	4.27	
Oakmound	......	......	......	2.72	
Olden†	80	22	54.4	2.57	
Oregon *a*	88	27	52.8	4.60	
Oregon *b*	89	27	53.5	4.48	
Osceola†	......	......	......	3.65	
Oto	......	......	......	3.41	
Palmyra *[5]	80	26	52.8	4.20	
Phillipsburg *†[1]	81	20	51.5	3.27	
Pickering *[3]	......	23	49.1	2.52	
Platte River	84	26	52.6	3.92	
Poplar Bluff	85	23	56.6	3.39	
Potosi	78	14	46.0	3.72	T.
Princeton	80	25	50.6	5.33	
Rhineland	84	22	52.1	3.62	
Richmond	84	28	51.4	2.70	
Rolla	......	......	......	4.08	
St. Charles	82	27	52.9	4.70	
St. Joseph	......	......	......	2.83	
Sarcoxie *[3]	81	28	50.6	3.01	
Sedalia	82	21	51.3	3.28	
Seymour	78	23	52.6	3.32	
Shelbina	......	......	......	3.40	
Sikeston	......	28	......	3.26	
Steffenville	80	23	52.2	3.56	
Stellada†	81	21	53.0	3.93	
Sublett	79	23	49.9	6.65	
Unionville	73	24	50.2	3.68	
Vichy	84	23	53.0	4.00	T.
Warrenton	84	24	51.0	5.03	
Wheatland	......	......	......	6.01	T.
Willow Springs	82	19	51.8	2.95	
Zeitonia	84	24	54.4	0.87	
Montana.					
Adel	75	−9	44.5	0.83	6.0
Augusta	89	7	44.8	1.45	......
Bigtimber	82	12	49.0	0.90	4.5
Boulder [h]	78	15	43.0	......	......
Bozeman†	78	16	45.4	1.07	2.5
Butte	74	16	41.6	0.51	0.8
Castle	72	13	39.3	0.47	4.4
Chinook†	76	−5	40.4	1.18	......
Columbia Falls	74	20	43.6	1.52	2.0
Crow Agency	85	16	50.4	0.54	T.
Dearborn Canyon	79	0	41.0	3.10	28.0

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Montana—Cont'd.	°	°	°	*Ins.*	*Ins.*
Deer Lodge	......	19	......	0.60	T.
Dupuyer	82	10	39.4	0.80	8.0
Fort Benton	86	6	45.8	0.96	2.0
Fort Keogh †	85	10	46.2	0.56	......
Fort Logan	75	— 3	40.0	0.66	......
Fort Missoula	82	23	48.7	1.57	....
Glasgow	77	6	42.8	1.43	......
Glendive †	75	16	45.0	2.00	T.
Glenwood	81	13	43.3	0.53	......
Greatfalls †	79	17	48.7	1.24	2.4
Kalispell	80	12	46.4	0.51	......
Kipp †	76	—13	39.0	1.90	17.7
Lewistown	81	7	43.9	1.15	4.0
Livingston †	81	13	46.6	1.04	3.5
Manhattan †	79	18	44.6	0.26	0.1
Martinsdale †	76	8	42.9	0.65	6.0
Marysville †	77	11	41.1	0.97	8.4
Parrot	80	20	46.8	0.25	0.0
Poplar	80	11	42.8	1.72	......
Radersburg	77	9	46.2	0.10	0.0
Redlodge	75	5	41.4	2.52	18.2
St. Ignatius Mission	79	25	46.4	1.48	
St. Pauls †	74	6	41.9	0.02	......
Troy	83	21	47.7	1.40	0.0
Utica	84	5	42.6	1.12	10.0
Virginia City †	76	15	43.4	0.74	3.5
Wibaux	86	10	39.6	1.52	......
Yale	80	4	42.1	0.42	3.0
Nebraska.					
Agee *[1]	89	23	47.7	1.99	
Albion	90	16	49.8	1.37	
Alliance	......	......	......	0.53	0.5
Alma *[1]	90	10	50.1	3.25	
Ansley †	87	11	48.7	2.69	0.5
Arapaho *[1]	84	9	49.4	4.51	
Arborville *[1]	86	18	46.0	2.88	T.
Ashland *a* †	90	24	50.9	3.46	
Ashland *b* *[1]	88	25	52.3	4.09	
Ashton	85	15	49.1	2.42	T.
Auburn *†[1]	90	22	52.7	2.92	
Aurora *[1]	86	24	49.0	1.67	
Beatrice †	83	24	49.2	3.53	
Beaver City †	91	11	52.0	2.27	T.
Benedict	......	......	......	3.01	
Benkelman	......	......	......	3.47	3.0
Blair	93	22	48.8	2.48	
Bluehill	......	......	......	4.91	
Brokenbow	......	......	......	2.54	
Burchard	......	......	......	2.35	
Burwell	......	......	......	1.68	T.
Callaway †	85	5	43.9	2.35	
Camp Clarke	93	14	50.2	1.07	1.0
Central City *[5]	88	30	52.6	2.20	
Cody	......	......	......	1.60	
Columbus †	88	20	49.2	2.45	
Cornlea	......	......	......	1.54	
Creighton †	85	15	46.5	1.82	
Crete	86	24	49.0	4.25	
Curtis *a*	92	16	53.8	2.32	
David City	86	22	48.8	2.75	1.0
Dawson	87	21	51.8	3.19	
Divide	......	......	......	2.04	
Dunning *[1]	82	20	47.0	0.83	
Eden	......	......	......	3.24	
Edgar	......	......	......	2.00	
Elba	......	......	......	1.20	0.5
Ericson *†[1]	90	22	41.1	1.38	T.
Ewing †	......	......	......	1.41	
Fairbury †	87	22	51.9	5.66	T.
Fairmont †	86	21	48.0	4.07	
Fort Robinson	71	14	46.0	0.50	
Franklin	93	14	50.2	4.46	
Fremont †	90	23	49.9		
Geneva †	87	22	50.8	3.91	T.
Genoa	89	20	49.5	2.78	
Gering	91	......	......	1.80	3.0
Gordon	......	......	......	0.60	
Gothenburg	85	15	48.8	1.09	T.
Grand Island *a* *[1]	93	29	53.0	3.73	
Grand Island *b*	84	21	48.2	2.81	0.9
Greeley *[1]	91	23	49.8	1.15	T.
Haigler	......	......	......	3.08	1.5
Hartington †	85	16	46.6	1.49	
Harvard	83	22	49.8	4.38	0.5
Hastings *[1]	81	25	49.8	4.26	
Hayes Center	......	......	......	3.65	
Hay Springs	84	17	45.6	1.11	1.0
Hebron †	87	22	50.5	3.91	
Hickman	......	......	......	5.12	
Holdrege *b* *[1]	87	27	46.4	3.35	0.2
Hooper *[1]	90	24	48.6	2.01	
Imperial †	89	16	51.9	1.82	0.5
Indianola (near) *[1]	84	22	50.2	3.18	
Johnstown	......	......	......	0.85	T.
Kearney	......	......	......	3.60	T.
Kennedy	92	14	45.8	1.38	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Kimball †	86	18	46.4	1.32	7.0
Kirkwood *[1]	90	22	47.3	1.52	......
Lexington †	82	10	50.4	2.23	......
Lincoln *b*	88	21	51.4	4.45	
Lincoln *d* †	80	26	49.6	3.51	
Lodgepole †	92	18	48.4	0.10	1.0
Loup *b* *[1]	84	18	47.8	2.48	
Lynch *†[1]	91	14	47.7	1.61	T.
Lyons	......	......	......	1.66	
McCook *[1]	86	30	54.4	2.55	2.0
McCool	......	......	......	3.62	
Madison	89	17	48.2	1.79	T.
Madrid *[5]	86	26	50.2	0.64	
Marquette	......	......	......	2.12	T.
Merriman	......	......	......	1.20	3.0
Minden *a*	88	18	49.2	4.02	1.5
Minden *b*	......	......	......	3.96	......
Monroe	......	......	......	2.48	
Nebraska City *a*	......	......	......	3.45	
Nebraska City *c*	87	19	49.8	2.31	
Nemaha *[1]	84	27	50.8	3.35	
Nesbit	84	15	46.8	1.73	
Norfolk *b*	86	17	48.2	1.49	T.
Norman	......	......	......	5.17	
North Loup	87	13	48.8	1.00	T.
Oakdale †	90	16	47.8	1.88	0.4
Odell *[5]	84	26	50.8	4.68	
O'Neill †	87	14	46.2	1.39	
Ord	88	12	46.8	2.09	
Osceola	......	......	......	1.96	
Ough †	......	......	......	3.80	2.0
Palmer *b*	......	......	......	1.98	
Plattsmouth *a*	......	......	......	3.09	
Ravenna *a*	85	14	48.6	2.23	1.5
Redcloud *a*	......	......	......	3.19	
Redcloud *b* *[1]	85	20	54.1	3.10	
Republican *[1]	82	28	51.2	4.68	
Rulo *[1]	90	26	53.1	3.20	
St. Libory	86	22	49.4	2.09	
St. Paul	82	24	50.4	2.27	T.
Salem *[1]	86	28	50.8	3.10	
Santee Agency †	90	17	49.7	1.10	
Sargent	......	......	......	2.33	
Schuyler	......	......	......	0.95	
Seneca *[1]	74	20	45.5	0.50	
Seward *[1]	83	27	48.6	4.70	
Springview	86	21	50.0	0.70	
Stanton *[1]	91	22	47.8	1.43	
Stockham	......	......	......	2.90	
Strang *[1]	88	27	52.5	4.33	T.
Stratton	......	......	......	3.23	
Superior *[5]	84	20	52.2	2.57	
Syracuse	......	......	......	4.44	
Tablerock	......	......	......	2.70	
Tecumseh *b* †	88	21	52.2	3.18	
Tekamah	94	21	50.0	1.86	
Thedford *[1]	82	12	44.2	1.90	
Turlington †	82	21	46.8	3.98	
Valentine †	88	18	46.4	1.33	
Valparaiso	......	......	......	3.07	
Wakefield	90	16	48.6	1.25	
Wallace	......	......	......	0.55	
Weeping Water *[1]	88	20	46.8	3.10	T.
Westpoint †	91	14	50.1	1.79	
Whitman	......	......	......	0.74	1.0
Wilber *[1]	84	30	53.2	5.80	
Willard	......	......	......	2.13	
Wilsonville *[1]	84	14	49.6	2.35	
Wisner	......	......	......	1.52	
Wymore *[1]	85	28	52.3	4.37	T.
York *[1]	88	24	49.8	4.73	
Nevada.					
Austin	77	18	49.4	1.16	2.0
Battle Mountain *[1]	86	30	52.1	0.26	
Beowawe *[1]	87	30	53.0	0.60	
Blaine	82	19	47.6	2.18	5.0
Bunkerville	......	......	......	0.30	
Candelaria	85	25	55.1	0.62	
Carlin *[1]	77	28	44.6	0.75	
Carson City	82	20	50.6	0.53	2.2
Cranes Ranch	......	......	......	0.66	T.
Elko *[8]	82	30	53.0	0.48	
Elko (near)	82	12	46.2	1.40	
Ely	77	18	47.6	1.15	
Empire Ranch	80	21	52.2	0.79	4.5
Fenelon *[1]	80	28	45.9	1.73	3.5
Golconda *[1]	74	30	48.4	0.00	
Halleck *[1]	85	27	47.2	0.30	
Hawthorne *a* *[2]	86	35	58.0	T.	
Hawthorne *b*	88	27	56.3	T.	
Hot Springs *[1]	90	37	67.2	T.	
Humboldt *[1]	84	32	54.2	0.00	
Keysers Springs *[1]	88	24	46.3	0.25	
Lewers Ranch	81	20	51.4	1.18	5.5
Los Vegas	90	34	61.5	0.00	
McGill	79	20	48.4	0.70	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Nevada—Cont'd.	°	°	°	*Ins.*	*Ins.*
Martins	82	21	51.6	0.44	6.2
Midas	76	16	50.4	1.38	2.0
Mill City *[1]	90	30	54.4	0.00	
Monitor Mill	79	17	46.6	0.49	T.
Osceola	78	29	54.7	0.80	
Palisade *[1]	80	30	52.6	0.75	
Palmetto	83	15	49.6	1.85	3.0
Panaca	96	20	56.8	1.25	
Reno *[8]	94	25	52.0	......	......
Reno State University	82	22	50.8	0.41	1.5
Ruby Valley	......	......	......	0.76	0.3
St. Clair	85	22	54.1	0.08	
St. Thomas	103	25	63.6	0.06	
San Antonio [d]	85	20	52.2	0.85	
Sodaville	90	19	56.5	0.58	
Tecoma *[1]	71	30	47.6	2.50	
Toano *[1]	80	30	49.5	1.50	T.
Tuscarora	76	12	41.7	0.19	T.
Tybo	82	28	54.8	0.90	
Verdi *[1]	95	18	44.8	0.10	
Wadsworth	......	......	......	0.30	
Wells	80	20	47.9	0.78	
New Hampshire.					
Alstead *[6]	63	15	40.6	3.58	4.0
Berlin Mills	70	5	39.7	2.90	10.0
Bethlehem	63	6	38.7	3.09	10.5
Brookline *[1]	75	12	41.2	5.70	8.0
Claremont	68	13	41.2	3.81	5.0
Concord	70	12	41.6	4.24	5.5
Durham	71	14	41.4	5.37	7.0
Grafton †	69	6	39.0	3.24	2.0
Hanover	69	10	41.3	2.82	1.0
Keene	70	12	41.2	3.58	2.5
Littleton	69	9	41.0	0.90	7.7
Nashua	73	15	42.0	4.74	10.0
Newton	72	12	41.1	5.97	4.0
North Conway	72	12	42.0	2.45	2.5
Peterboro	68	12	39.6	3.93	......
Plymouth	70	10	41.2	2.83	2.6
Sanbornton †	67	12	39.9	3.25	2.0
Stratford	70	6	40.2	2.13	4.8
Warner	......	......	......	4.94	3.0
New Jersey.					
Asbury Park	79	20	48.2	3.27	3.5
Barnegat	74	25	48.1	3.64	......
Bayonne	77	23	48.8	3.79	4.0
Belvidere	76	15	46.0	3.64	2.0
Bergen Point	76	25	48.4	4.28	4.0
Beverly †	80	20	49.6	3.84	3.0
Billingsport *[1]	76	27	48.9	3.06	5.3
Boonton	77	20	47.0	3.31	3.0
Bridgeton	79	24	51.0	3.85	......
Camden	79	24	49.4	3.29	3.1
Cape May C. H. †	75	24	48.8	4.21	T.
Charlotteburg	75	13	44.7	4.10	1.0
Chester	72	18	45.0	3.08	3.0
Clayton	78	21	48.7	2.88	2.5
College Farm †	77	16	48.6	4.87	3.7
Deckertown	76	17	46.1	3.61	2.0
Dover	78	15	45.2	3.21	3.5
Egg Harbor City	78	21	47.6	3.20	1.0
Elizabeth †	79	20	48.4	4.66	T.
Englewood	76	14	45.0	3.78	5.0
Flemington	79	17	48.4	3.64	4.0
Franklin Furnace	75	13	45.6	2.17	T.
Freehold	74	18	47.6	3.83	T.
Friesburg	77	21	49.4	3.02	1.6
Gillette	74	18	46.6	3.84	4.0
Hammonton	......	......	......	3.42	......
Hanover	75	20	47.8	4.29	3.0
Hightstown	78	20	49.2	4.26	2.5
Imlaystown	78	19	48.6	3.17	2.8
Junction	......	......	......	3.50	2.2
Lambertville	78	19	48.6	3.56	4.5
Moorestown	78	21	49.0	3.69	4.0
Newark *b* †	78	24	48.5	4.70	3.5
New Brunswick *a*	77	17	49.4	4.54	4.0
Newton	76	17	45.3	3.22	......
Ocean City	77	24	47.8	4.54	......
Oceanic	72	23	46.8	3.16	3.0
Paterson	80	24	49.4	3.79	3.5
Plainfield	76	15	46.6	4.82	3.0
Port Norris [f]	79	23	49.4	1.34	......
Rancocas	......	......	......	3.31	4.6
Rivervale	74	20	44.7	4.94	4.0
Roseland	76	15	45.9	4.01	4.0
Salem	77	24	50.2	3.75	1.0
Somerville	79	15	48.4	4.41	2.5
South Orange	76	22	47.1	4.61	3.0
Staffordville	......	......	......	3.60	T.
Toms River	79	15	47.2	3.93	4.0
Trenton	76	21	50.4	3.57	3.0
Vineland	81	22	48.8	2.67	1.5
Woodbine	79	18	48.2	2.75	......
New Mexico.					
Albert	89	25	57.2	1.04	

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	Ins.	Ins.
New Mexico—Cont'd.					
Albuquerque†	83	29	57.1	0.33	
Alma	89	27	58.4	1.40	
Aztec†	82	17	51.4	1.31	
Bernalillo†	90	31	58.7	0.57	
Bluewater	84	11	51.0	0.75	
Buckmans	71	16	41.8	1.34	4.0
Clayton	89	22	54.0	1.27	3.0
Deming*[8]	90	44	60.2	0.30	
East Lasvegas†	79	19	50.4	1.41	T.
Eddy	94	26	61.4	0.70	
Engle†	86	28	58.5	0.93	
Espanola	82	21	52.9	1.04	
Folsom	81	22	49.6	1.56	8.5
Fort Bayard	81	27	55.0	0.57	
Fort Union	75	10	45.8	2.17	T.
Fort Wingate	82	20	51.9	0.20	
Gallinas Spring†	88	20	56.0	1.70	
Gila	91	30	62.4	1.04	
Hillsboro	94	32	60.3	0.48	
Laluz	87	29	62.0	0.67	
Las Cruces†	90	29	60.4	0.69	
Lordsburg*[8]	88	42	64.6	0.16	
Los Lunas	85	28	57.1	0.75	
Lower Penasco	80	22	55.2	1.65	
Monero	75	14	42.9	1.93	
Puerto de Luna	89	25	58.7	0.78	
Rincon†	91	28	61.8	0.55	
Roswell†	93	20	59.7	0.34	
San Marcial		26		0.65	
Shattucks Ranch	89			0.91	T.
White Oaks†	80	23	53.4	1.04	T.
Winsors Ranch	72	14	43.0	1.30	T.
New York.					
Adams				2.28	
Addison	74	13	42.8	2.51	2.0
Akron				1.76	
Alden	66	12	41.8	2.05	1.0
Alfred	69	8	39.4	2.50	3.0
Angelica†	70	6	40.2	2.72	6.0
Appleton	66	21	42.5	1.41	1.0
Arcade	67	8	39.5	2.90	4.9
Atlanta				2.89	
Auburn	73	14	44.4	2.94	3.5
Avon	69	15	42.3	1.46	
Baldwinsville	70	17	44.0	2.23	3.0
Bedford	76	17	45.6	3.53	4.9
Big Sandy*[10]	62	13	41.8		
Binghamton†	72	17	42.4	3.37	3.0
Bolivar	71	13	40.1	2.90	6.0
Bouckville	66	8	39.8	4.39	5.0
Boyds Corners				3.84	
Brentwood	75	12	46.2	5.90	6.0
Brooklyn	78	25	49.0	4.36	4.5
Canajoharie	70	20	44.6	2.98	
Canton	68	10	40.8	1.47	2.5
Carmel	74	20	46.2	3.78	1.5
Carvers Falls	73	10	42.2	2.67	T.
Catskill	72	21	45.0	3.08	2.0
Cedarhill	82	12	44.6	2.83	1.0
Charlotte*[10]	56	20	37.5		
Chenango Forks				3.45	
Cherry Creek				3.10	
Cooperstown†	66	14	40.1	4.00	1.0
Cortland	67	14	41.4	3.43	4.0
Dekalb Junction				1.22	
Dryden	69	15	40.8	3.58	0.3
Eagle Mills				2.40	
Easton				2.85	
Elizabethtown	70	8	40.0		
Elmira	76	20	44.8	2.84	1.0
Fleming	68	17	43.1	2.29	1.0
Fort Niagara†	68	19	43.2	1.47	T.
Franklinville	69	1	39.2	3.32	7.5
Fulton				1.04	
Garrattsville	68	10	40.4	2.26	T.
Gloversville	73	14	41.8	4.19	1.5
Greenwich	69	12	43.0	3.07	0.2
Haskinsville				2.71	
Honeymead Brook	71	11	43.1	3.63	1.0
Humphrey†	69	12	41.6	3.22	6.5
Ithaca	69	18	41.7	3.58	3.2
Jamestown	69	15	42.2	3.39	8.0
Keene Valley	64	9	37.1	2.85	0.5
Kings Station				3.41	
Lake George	73	15	43.6	2.96	T.
Lake Placid	64	4	37.2	2.93	4.5
Liberty	67	13	38.8	3.21	2.0
Little Falls	69	16	41.6	2.96	1.5
Lockport	72	20	43.6	1.80	1.5
Lowville	69	4	40.0	2.24	3.0
Lyndonville				1.33	
Lyons	68	21	44.0	1.99	T.
Madison Barracks†	70	2	42.2	1.17	2.0
Middletown	73	19	44.6	3.86	2.5
Mohonk Lake	68	19	42.2	2.66	
Mount Morris				1.80	T.
New York—Cont'd.					
Napoli				2.46	
Newark Valley				3.72	
New Lisbon	69	10	38.6	2.77	0.8
Niagara Falls				1.66	
North Hammond†	74	16	43.4	1.44	
North Lake	66	4	36.6	3.47	5.0
Number Four†	66	−2	37.5	3.27	11.1
Nunda	72	15	41.7	3.85	5.0
Ogdensburg	71	13	43.9	0.83	0.5
Oneonta	71	16	42.2	3.42	
Oxford	70	14	40.6	4.90	1.5
Palermo	67	16	41.3	1.75	3.5
Penn Yan	73	16	44.0	2.23	0.5
Perry City	70	14	40.4	3.64	1.6
Phœnix				3.09	
Pine City				2.99	
Plattsburg Barracks†	67	13	41.8	1.95	T.
Port Jervis	78	14	45.2	3.23	3.0
Poughkeepsie	75	10	44.4	2.96	2.5
Primrose	77	18	45.6	4.09	3.0
Ridgeway	66	19	42.8	1.65	0.9
Rome	68	16	42.4	4.19	
Romulus	71	17	43.5	3.60	T.
Rose				2.32	
St. Johnsville	72	17	43.9	3.82	0.5
Saranac Lake	69	5	38.6	2.56	2.5
Saratogo Springs	71	15	43.7	2.72	0.5
Scottsville				1.88	
Setauket†	70	23	46.0	4.90	3.0
Sherwood				2.57	
Skaneateles				3.63	
South Canisteo	72	8	40.5	3.35	5.5
Southeast Reservoir				3.50	
South Kortright†	68	5	38.3	2.54	
Straits Corners	73	16	42.2	4.02	2.5
Ticonderoga	72	10	45.2	1.98	T.
Victor	70	17	42.6	3.38	2.5
Wappingers Falls	79	14	46.0	5.16	5.0
Warwick				3.32	
Watertown	72	4	43.7	2.07	5.0
Watkins	70	18	41.9	2.05	1.0
Waverly†	75	16	42.7	3.55	0.7
Wedgwood	73	14	41.6	2.91	2.5
Westfield	68	19	42.8	2.74	4.0
Westpoint†	77	21	45.8	3.72	
Willetspoint	75	23	46.2	4.42	1.9
North Carolina.					
Abshers	85	20	51.6	2.68	
Asheville†	81	22	49.1	3.42	
Beaufort†	78	34	57.1	3.92	
Biltmore†	83	25	50.6	3.52	
Bryson City†				3.40	
Chapelhill†	86[f]	28	56.6[a]	3.11	
Edenton	82	31	55.9	5.28	T.
Experimental Farm	84	30	55.3	3.21	
Fairbluff†				6.17	
Fayetteville†	88	32	56.6	4.75	
Flatrock	78	25	49.1	3.90	
Greensboro†	85	26	54.0	2.68	
Greenville	84	32	56.8		
Henderson†	85	26	52.9	3.58	
Highlands	71	20	45.4	5.83	1.0
Lenoir*†[1]	79	29	52.9	2.33	
Linville†	73	15	43.2	3.03	1.0
Littleton†	84	25	53.1	2.82	
Louisburg†	86	29	55.0	2.84	
Lumberton†		32		6.60	
Lynn†	83	30	54.0	3.52	
Mana				2.78	
Marion	85	28	52.8	2.81	
Mocksville[1]	79	31	53.0	3.49	
Moncure†	84	31	55.4	2.90	
Monroe†	83	25	53.8	3.16	
Morganton	84	27	53.9	2.82	
Mountairy	83	19	51.8	2.65	
Mount Pleasant	85	29	53.8	3.17	
Murphy†				6.12	
Newbern	90	32	58.2	4.16	
Oakridge†	83	23	53.8	2.88	
Pantego				4.45	T.
Pittsboro†	86	29	53.0	3.07	
Rockingham†	85	29	56.1	4.07	
Roxboro†	84	22	51.4	2.51	
Salem†	85	26	53.6	3.52	
Salisbury†	87	28	55.6	2.82	
Saxon†	86	22	52.4	3.00	
Selma	88	28	55.1	4.50	
Settle	88	26	52.8	2.67	
Sloan†	85	31	57.2	4.82	
Soapstone Mount†	88	24	52.4	3.24	
Southern Pines *a*†	87	32	58.8	4.39	
Southern Pines *b*	87	31	57.6	3.61	
Southport†	78	31	58.6	4.23	
Springhope*[1]	82	30	51.7	3.30	
Tarboro	89[a]	26[a]	55.8[a]	3.39	
Wash Woods				4.50	
North Carolina—Cont'd.					
Waynesville†	78	22	47.8	3.95	T.
Weldon†	87	30	55.2	3.65	
North Dakota.					
Amenia	73	12	43.8	1.60	
Aneta	72	12	43.2	0.80	
Ashley†	75	9	42.4	1.54	
Berlin	73	12	43.0	1.41	T.
Bottineau	78	9	38.7	0.55	1.0
Buxton	69	14	41.3	1.15	
Churchs Ferry	76	12	42.7	1.26	2.5
Coal Harbor	77	15	42.0	1.12	
Devils Lake	75	11	41.4	0.19	
Dickinson	78	12	42.0	1.02	T.
Ellendale	79	13	43.0	1.23	
Fargo†	72	10[a]	41.5[a]	0.88	
Forman†	75[b]	13[b]	42.2[b]	1.19	T.
Fort Berthold	80	−5	44.0	0.33	
Fort Yates†	85	15	45.2	2.90	
Fullerton[1]	74[a]	11	42.4	1.35	0.0
Gallatin†	73	3	41.1	0.84	0.5
Glenullin	68	11	38.2	0.93	
Goetz	79	3	41.0	1.31	
Grafton†	75	12	41.4	1.10	
Hamilton	72	8	40.2	1.71	T.
Jamestown†	80	13	43.4	1.11	
Kelso	72[d]	17[d]	43.8[d]	1.36	
Langdon	71	8	39.0	1.00	T.
Larimore†	73	13	40.9	0.53	T.
Lisbon	74	13	43.0	0.52	
McKinney	82	−2	38.8	0.87	
Mayville	74	16	46.0	2.25	
Medora†	79	10	45.6	2.20	
Melville	75	13	42.0	0.86	
Milton†	70	10	40.4	0.88	0.5
Minnewaukon	74	10	41.2	1.00	
Minot	87	8	44.5	1.55	T.
Minto†	77	10	42.8	1.08	
Napoleon†	78	14	42.2	2.67	
New England City	75	11	38.1	3.10	
Oakdale†	78	7	41.6	1.96	2.0
Portal	82	2	37.6	0.82	
Power†	70	11	42.4	2.81	
St. John†	72	9	39.8	0.63	
Sheyenne	74	9	40.6	0.90	
Steele†	71	18	42.2	1.46	
Towner†	75	8	41.2	0.15	
University	74	15	43.0	4.16	
Valley City†	73	12	43.0	1.50	
Wahpeton†	83	13	47.5	1.45	
Washburn	81	5	42.2	1.85	
White Earth	84	8	38.6	1.55	0.2
Wildrice†[2]			42.5	2.31	T.
Willow City	75	9	42.4	0.00	
Woodbridge†	78	6	39.8	0.93	
Ohio.					
Akron	78	18	46.0	2.77	0.8
Annapolis	78	18	45.8	2.32	T.
Ashland	78	19	45.9	2.57	0.5
Ashtabula	67	21	43.8	2.50	2.0
Atwater				2.55	1.0
Bangorville	80	17	46.9	3.01	T.
Basil				3.71	T.
Bellefontaine	77	20	46.7	2.96	
Bement				3.25	1.3
Benton Ridge	80	18	46.7	2.29	T.
Bethany	79	24	52.4	1.56	
Bigprairie	79	20	47.1	2.30	
Binola				2.23	1.5
Bissells	73	21	46.6	2.21	1.3
Bloomingburg	79	21	48.4	2.40	
Bowling Green	79	18	45.9	1.91	
Bucyrus	80	16	44.4	2.66	
Cambridge	78	18	46.0	2.99	T.
Camp Dennison	79	22	49.8	1.42	0.5
Canal Dover	80	17	45.2	2.40	T.
Canton†	78	20	46.5	2.63	0.8
Carrollton	77	18	46.6	2.13	T.
Cedarville				2.01	
Celina	82	17	47.0	2.85	
Cherryfork	77	20	49.6	1.89	1.0
Chillicothe	80	23	47.9	2.09	T.
Circleville	78	23	49.2	2.26	1.0
Clarksville	77	22	49.2	1.56	0.2
Cleveland *a*	68	22	45.2	1.80	0.7
Cleveland *b*	66	19	44.6	1.80	0.2
Coalton	81	13	47.6	1.76	6.0
Colebrook	74	17	44.1	1.74	T.
Dayton *a*	81	22	49.4	1.89	
Dayton *b*†				1.84	
Defiance	81	16	45.6	2.19	T.
Delaware	79	21	47.8	3.01	T.
Demos	77	17	45.2	2.37	2.0
Dupont	83	18	46.3	1.90	
Elyria	74	21	45.7	2.41	0.2
Fairport Harbor*[10]	67	26	45.1		
Fayetteville	78	20	48.4	2.00	2.5

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Ohio—Cont'd.	°	°	°	*Ins.*	*Ins.*
Findlay	85	17	47.0	2.08	
Frankfort	80	21	48.6	2.66	T.
Garrettsville†	72	18	44.2	2.66	0.5
Granville	79	21	46.5	4.13	
Gratiot	77	21	47.2	3.71	0.8
Greenfield	78	24	49.0	1.75	0.5
Greenhill	77	13	44.5	1.71	0.3
Greenville	76	18	46.9	2.32	
Hackney	72	21	50.6	2.69	2.0
Hanging Rock	83	17	47.2	1.97	
Hedges	85	16	46.8	1.58	
Hillhouse	69	15	41.7	1.72	
Hillsboro†	82	20	48.8	1.80	1.5
Hiram	70	18	45.2	2.69	0.5
Hudson	74	16	44.8	2.31	
Jacksonboro	82	20	50.2	0.85	
Kenton	84	19	48.4	4.19	
Killbuck	78	20	47.0	3.06	T.
Lancaster	77	21	48.4	4.54	1.0
Leipsic	81	16	45.0	1.95	T.
Levering	79	18	45.9	3.85	
Logan	83	19	48.5	2.98	2.5
Lordstown	68	18	44.8	2.01	T.
McArthur	79	15	46.8	1.76	5.0
McConnelsville†	82	19	47.2	3.33	2.0
Mansfield†	......	......	......	3.20	
Marietta *b*	79	23	50.2	2.30	3.0
Marion	81	19	48.1	2.99	
Medina	78	10	45.3	2.42	1.0
Milfordton	78	18	44.6	3.53	T.
Milligan	83	18	47.4	3.62	2.0
Millport	76	12	45.2	2.13	T.
Montpelier	77	17	46.0	1.18	T.
Napoleon	79	13	46.2	1.86	
Neapolis	......	......	......	1.50	T.
New Alexandria	74	18	47.0	2.90	1.5
New Berlin	77	15	45.8	1.90	T.
New Bremen	75	16	47.9	0.89	
New Holland	78	19	48.6	2.00	1.0
New Paris	75	19	48.2	1.84	T.
New Waterford	76	19	47.2	1.83	T.
North Lewisburg	81	19	47.2	2.85	
North Royalton	73	18	44.8	2.02	
Norwalk	78	21	45.4	2.14	1.0
Oberlin	69	20	47.8	2.41	
Ohio State University	80	23	48.5	2.30	
Orangeville	71	16	43.4	1.68	T.
Ottawa	83	17	49.0	2.26	T.
Pataskala†	79	22	47.8	3.98	0.1
Perry	......	......	......	2.21	0.5
Philo	81	19	48.9	3.80	3.0
Plattsburg	77	21	47.7	2.17	T.
Point Marblehead *[10]	72	28	48.5	......	
Pomeroy	83	18	50.0	1.18	5.5
Portsmouth *a*†	......	......	......	2.05	4.0
Portsmouth *b*	82	22	52.3	2.05	6.0
Richwood	73	20	48.7	2.94	T.
Ridgeville Corners	80	14	46.2	1.66	T.
Ripley	78	22	49.6	1.82	3.2
Rittman	76	13	44.0	3.06	T.
Rockyridge	77	18	46.1	2.14	T.
Rosewood	77	18	46.1	2.42	
Shenandoah	80	19	44.8	2.20	T.
Sidney *b*	81	20	47.0	2.99	
Sinking Spring†	71	20	46.8	1.51	3.0
Somerset†	80	23	51.2	3.84	
Springboro	......	......	......	1.50	
Spring Valley	77	21	48.2	1.76	
Strongsville	......	......	......	2.37	
Sylvania	75	15	45.5	1.46	
Thurman	87	15	49.9	1.15	2.0
Tiffin †	79	19	46.6	1.84	T.
Upper Sandusky	80	21	47.6	2.27	T.
Urbana	77	21	47.2	2.38	
Vanceburg	81	19	50.4	2.93	4.0
Vanwert	82	19	46.9	2.60	
Vermillion	71	19	44.4	2.15	1.0
Vickery	76	19	46.3	2.04	0.1
Walnut	......	......	......	2.77	3.0
Warren	72	20	44.7	1.94	1.5
Warsaw	82	19	47.4	2.91	T.
Wauseon	80	16	46.8	2.03	T.
Waverly	81	20	49.6	1.83	3.2
Waynesvile	76	20	47.0	1.56	
Westerville	78	22	47.9	2.77	T.
Willoughby	......	......	......	2.09	
Wooster *b*†	77	16	45.3	2.56	0.8
Youngstown	72	20	47.5	2.07	
Zanesville†	......	......	......	3.41	1.0
Oklahoma.					
Anadarko†	90	25	60.6	0.79	
Arapaho†	96	27	57.3	1.39	
Beaver	......	......	......	1.02	
Burnett†	87	26	59.1	2.39	
Clifton†	82	24	57.6	1.26	
Edmond	86	28	58.8	0.72	
Oklahoma—Cont'd.	°	°	°	*Ins.*	*Ins.*
Fort Reno†	......	......	......	1.14	
Fort Sill	89	30	59.0	5.86	
Hennessey	87	23	55.3	0.60	
Hopeton	92	19	62.5	1.26	
Jefferson	90	20	59.0	1.61	
Kingfisher	85	26	59.3	0.44	
Mangum†	94	28	59.0	1.12	
Newkirk	91	24	57.0	1.28	
Norman†	88	27	59.4	1.87	
Pawhuska	87	27	56.6	1.36	
Prudence†	79[c]	27[c]	55.2[c]	1.32	
Putnam	92	18	56.3	1.08	
Sac and Fox Agency	85	24	57.8	1.23	
Stillwater†	86	26	58.4	0.58	
Waukomis	89	27	58.2	0.80	
Winnview	85[j]	25[j]	55.8[j]	1.08	
Oregon.					
Albany *a*	77	32	52.6	2.57	
Arlington	80	29	54.2	0.10	
Ashland *b*	86	25	52.2	0.42	0.1
Aurora *[8]	77	35	52.7	2.51	
Aurora (near)	81	27	51.0	2.32	
Bandon	61	32	49.0	3.54	
Bay City†	66	29	48.2	8.85	
Beulah	86	20	49.6	0.08	
Brownsville *[8]	75	38	53.1	2.03	
Burns	82	20	45.4	T.	
Burns (near)	82	18	49.1	0.10	
Cascade Locks	78	31	52.6	3.13	
Comstock *[8]	84	29	50.2	1.93	
Coquille River				0.31	
Corvallis	80	30	51.7	2.44	
Dayville†	90	24	52.2	0.38	T.
Eugene	76	31	50.2	1.99	
Fairview	67	31	48.0	2.60	
Falls City	78	29	50.0	3.89	
Fife	85	11	44.5	0.50	T.
Forestgrove	89	25	51.0	2.55	
Fort Klamath	74	21	46.6	0.36	0.6
Gardiner	72	32	49.8	3.02	
Glenora	82	25	48.7	5.98	T.
Government Camp	71	12	40.0	4.49	16.0
Grants Pass *a*†	89	24	53.9	0.41	
Happy Valley	83	15	46.2	0.48	0.5
Heppner	77	24	48.8	0.82	
Hood River (near)	77	26	50.4	0.95	
Jacksonville	83	25	52.4	0.59	
Joseph	73	22	43.0	1.14	9.0
Junction City *[8]	84	30	54.6	2.59	
Lafayette *[8]	78	32	52.5	1.74	
Lagrande	84	26	49.9	1.56	
Lakeview†	79	19	47.8	0.05	0.5
Langlois	76	32	51.4	4.82	
Lone Rock	77	22	47.5	0.40	T.
McMinnville	82	28	51.6	2.33	
Merlin *[8]	90	26	51.2	0.48	
Monmouth *a* *[8]	81	31	53.0	2.62	
Monmouth *b*	79	28	50.5	1.93	
Monroe	78	29	50.7	2.82	
Moro	73	25	48.9	0.23	T.
Mount Angel†	84	30	52.4	3.18	
Newberg	80	28	51.7	2.61	
Newbridge	88	22	51.0	0.82	
Newport	73	31	48.3	3.37	
Pendleton	84	23	52.4	0.94	
Placer				0.97	
Prineville	92	12	50.1	......	
Riddles *[8]	82	28	52.2	0.49	
Riverside	89	20	49.4	0.14	
Salem *b*†	71	29	51.6	2.44	
Sheridan *[8]	76	40	53.4	1.73	
Silver Lake	81	8	43.8	0.22	0.8
Silverton *[8]	80	38	54.8	3.13	
Siskiyou *[8]	92	26	57.0	......	T.
Sparta	71	22	46.3	1.75	6.0
Springfield *[8]	78	31	51.0	2.01	
Stafford	80	29	50.6	30.1	
Stokes	91	26	54.5	0.23	
The Dalles†	82	30	54.0	0.11	
Tillamook Rock				3.73	
Umatilla				0.18	
Vale	87	18	50.7	0.06	
Vernonia	87	26	49.8	3.09	T.
West Fork *[8]	90	30	50.5	1.33	
Weston	86	30	52.6	2.73	
Williams	85	22	51.2	0.77	
Pennsylvania.					
Altoona	72	19	45.0	2.22	......
Aqueduct	83	18	50.3	2.59	4.0
Athens	75	18	43.0	3.47	T.
Beaver Dam	......	......	......	1.89	......
Bethlehem	......	......	......	3.37	......
Brookville†	......	......	......	2.35	0.3
Browers Lock	......	......	......	3.60	......
Cameron	......	......	......	2.72	......
Carlisle	78	22	48.0	2.52	3.5
Pennsylvania—Cont'd.	°	°	°	*Ins.*	*Ins.*
Cassandra	60	16	42.8	1.83	4.0
Cedarrun	......	......	......	3.42	T.
Centerhall†	73	18	45.0	2.60	2.5
Chambersburg†	74	20	46.7	1.32	0.5
Coatesville	80	19	49.0	3.79	4.0
Confluence†	78	8	41.8	2.83	0.7
Coopersburg	76	20	47.8	......	......
Davis Island Dam†	......	......	......	1.84	1.0
Derry Station	82	16	45.8	2.15	2.5
Doylestown	......	......	......	4.16	......
Driftwood	......	......	......	2.45	......
Duncannon	......	......	......	2.74	5.0
Dushore	73	4	41.0	3.47	1.4
East Bloomsburg	......	......	......	2.93	0.3
East Mauch Chunk	77	14	45.9	4.50	3.5
Easton	73	18	48.2	3.25	3.8
Ellwood Junction†	......	......	......	2.08	T.
Emporium	76	17	44.2	2.59	1.6
Everett	73	18	44.8	2.03	4.5
Farrandsville	......	......	......	2.93	......
Forks of Neshaminy *[1]	78	31	50.3	3.55	......
Franklin	75	17	44.8	1.53	......
Frederick	......	......	......	3.49	......
Freeport†	......	......	......	1.82	1.0
Girardville	......	......	......	4.21	4.0
Grampian	70	16	43.2	2.30	2.0
Greensboro†	84	8	47.6	4.06	5.0
Greenville	72	22	47.5	2.04	0.5
Hamburg	79	19	48.1	5.19	3.0
Hawley	75	26	44.8	3.26	2.7
Hews Island Dam	......	......	......	1.19	......
Hollidaysburg	72	18	45.8	1.99	2.0
Huntingdon *a*†	75	19	46.8	2.04	2.0
Huntingdon *b*	......	......	......	1.73	1.2
Indiana	71	22	49.4	4.13	......
Irwin	......	......	......	1.49	T.
Johnstown†	72	21	45.8	2.04	2.0
Karthaus	......	......	......	1.62	1.0
Keating	......	......	......	3.29	T.
Kennett Square	78	18	48.4	3.72	2.5
Lansdale	......	......	......	3.89	......
Lawrenceville	74[c]	15[c]	42.8[c]	2.99	2.2
Lebanon	78	18	47.5	3.18	6.5
Leroy†	74	14	42.2	4.61	2.5
Lewisburg	78	21	46.9	2.83	2.0
Lock Haven *a*†	81	19	48.2	3.17	1.0
Lock Haven *b*	......	......	......	2.24	0.5
Lock No. 4†	......	......	......	2.05	0.2
Lycippus	77	6	44.8	2.25	4.5
Mifflin	......	......	......	2.50	0.2
Oil City†	......	......	......	2.13	1.9
Ottsville	......	......	......	4.46	......
Parker†	......	......	......	1.99	
Philadelphia *b*	80	24	50.0	3.02	3.1
Point Pleasant	......	......	......	3.11	......
Pottstown	77	21	49.0	3.86	3.0
Quakertown	76	15	45.8	3.66	4.0
Reading[2]	......	......	47.6	3.73	......
Reedsville	74	20	46.1	......	......
Renovo *a*	......	......	......	3.04	T.
Renovo *b*	79	19	46.2	3.25	......
Ridgway†	......	......	......	1.89	2.0
Saegerstown	76	10	42.0	2.08	1.0
St. Marys	74	15	41.6	2.11	T.
Salem Corners	67	14	41.3	3.29	3.2
Scranton	77	19	45.0	2.47	4.0
Seisholtzville	......	......	......	4.04	......
Selinsgrove	79	20	46.8	2.98	2.0
Shawmont	......	......	......	2.56	1.7
Shinglehouse	64	12	39.2	1.98	4.0
Sinnamahoning	......	......	......	2.14	......
Smethport	74	15	41.2	2.35	2.0
Smiths Corners	......	......	......	3.68	......
Somerset	72	12	46.6	4.51	9.2
South Bethlehem	78	20	49.2	......	......
South Eaton	74	17	44.1	2.73	T.
State College	73	17	44.8	2.29	2.0
Sunbury	......	......	......	2.10	2.0
Swarthmore	77	22	49.8	2.71	......
Swiftwater	70	16	42.6	5.34	1.0
Towanda	75	18	43.8	3.29	1.0
Trout Run	......	......	......	3.88	
Uniontown	78	16	47.0	4.19	9.0
Warren†	75	16	43.6	3.02	3.2
Wellsboro†	76	17	42.6	4.43	0.5
West Chester	76	18	48.0	3.07	2.0
West Newton†	......	......	......	1.91	3.0
White Haven	74	15	43.3	3.63	3.5
Wilkesbarre†	78	18	45.0	2.46	3.0
Williamsport	76	21	45.3	2.81	T.
York†	77	16	47.0	2.71	3.6
Rhode Island.					
Bristol	65	25	44.0	4.94	3.5
Kingston	71	17	42.6	5.56	5.0
Lonsdale	......	......	......	5.70	5.0
Pawtucket	72	27	46.6	5.64	3.0

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Rhode Island—Cont'd.	°	°	°	*Ins.*	*Ins.*
Providence *a*	74	26	45.4	6.08	3.0
Providence *b*	72	21	43.5	6.46	5.0
South Carolina.					
Allendale	84	34	58.3	5.33	
Anderson †	......	......	......	4.03	
Batesburg †	85	32	57.6	4.90	
Blackville †	87	35	59.1	6.77	
Camden †	......	......	......	4.88	
Central	83	25	56.2	3.72	T.
Cheraw *a* †	87	29	56.2	4.78	
Cheraw *b* †	......	......	......	5.08	
Clemson College	82	27	55.2	3.63	
Conway †	......	......	......	4.27	
Darlington	......	......	......	5.68	
Edisto †	......	......	......	7.61	
Effingham †	......	......	......	4.81	
Gaffney †	......	......	......	4.40	
Georgetown †	84	37	61.8	4.95	
Gillisonville	91	30	60.8	6.07	
Greenville †	79	31	52.6	4.51	
Greenwood	84	34	56.6	4.12	
Holland	81	26	53.4	6.23	
Kingstree *a* †	87	30	58.0	4.97	
Kingstree *b*	......	......	......	5.06	
Little Mountain	85	26	56.9	5.75	T.
Longshore †	82	27	55.8	4.83	T.
Marion	82[c]	34[c]	58.8[c]	4.39	
Mount Carmel †	......	......	......	5.05	T.
Pinopolis *[1]	82	38	58.6	5.43	
Port Royal †	81	41	63.3	3.75	
St. Georges †	85	37	59.3	6.10	
St. Matthews †	85	35	59.0	5.57	
St. Stephens †	......	......	......	5.00	
Santuck †	81	28	54.8	4.72	
Shaws Fork *[1]	92	31	60.6	5.90	
Smiths Mills †	......	......	......	5.61	
Society Hill †	83	35	58.4	5.99	
Spartanburg	......	......	......	3.64	
Statesburg †	85	34	59.5	5.65	
Trenton	82	36	59.8	5.64	
Trial	84	29	56.0	5.42	
Walhalla	83	26	54.5	4.54	T.
Winnsboro	89	30	56.3	4.26	
Yemassee †	87	34	60.4	7.29	
Yorkville	87	32	58.0	3.85	
South Dakota.					
Aberdeen †	82	13	44.3	......	
Alexandria †	89	12	47.0	1.75	
Armour	88	15	48.6	1.87	T.
Ashcroft †	87	5	43.2	0.97	T.
Bowdle	84	11	42.3	1.69	
Brookings †	85	10	45.6	0.88	
Canton	88	16	48.2	1.38	
Castlewood [c]	76	12	42.8	1.25	T.
Centerville	......	......	......	1.11	
Chamberlain †	91	17	49.0	1.24	
De Smet	85	14	44.0	2.55	
Doland	88	13	44.8	2.17	T.
Edgemont	......	......	......	1.45	2.0
Farmingdale	......	......	......	1.46	
Flandreau	91	16	46.4	1.73	......
Forestburg †	87	12	45.8	1.70	
Forest City	89	14	46.6	0.10	
Fort Meade †	84	14	44.0	1.20	5.0
Gann Valley	87	13	46.5	1.75	
Gary	82	17	43.8	0.30	
Goudyville	88	5	44.4	1.34	
Greenwood	87	15	47.6	1.23	0.2
Harney	85	11	42.6	1.04	5.0
Highmore	84	11	45.0	1.51	
Hotch City †	92	7	46.0	1.06	
Hot Springs	78	19	45.7	0.73	2.5
Howard †	87	14	45.6	2.11	
Interior	89	18	47.7	0.50	
Ipswich	87	11	44.8	1.97	
Kimball †	88	14	46.6	2.58	
Leslie †	92	5	45.0	1.75	
Mellette †	87	12	46.8	1.65	
Menno †	89	14	48.2	1.32	
Millbank	82	15	44.3	1.08	
Mitchell †	88	13	45.8	1.30	
Montrose	88	15	46.8	3.35	
Nowlin	93	13	46.0	2.67	1.0
Oelrichs †	91	18	47.8	0.36	
Parker †	86	14	45.4	1.69	
Parkston	86	15	46.4	1.80	
Plankinton †	87	13	46.6	1.33	T.
Redfield	87	13	44.0	0.95	
Rochford	82	— 3	39.0	1.17	1.3
Rosebud	90	14	47.0	1.41	4.0
Shiloh	87	17	46.0	0.93	
Silver City	......	......	......	1.22	3.5
Sioux Falls †	85	14	46.2	1.97	
Spearfish †	85	13	45.0	1.14	6.0
Tyndall †	88	16	47.2	0.42	
Watertown	82	13	43.8	1.74	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
South Dakota—Cont'd.	°	°	°	*Ins.*	*Ins.*
Wentworth †	88	15	45.7	1.54	
Wolsey	......	......	......	2.17	
Tennessee.					
Andersonville	82	25	51.5	3.05	
Ashwood *†[1]	79	30	55.0	5.32	
Benton (near) †	81	27	53.4	4.60	
Bluff City †	......	......	......	3.27	
Bolivar †	85	27	55.8	2.70	
Bristol †	76	20	48.4	2.88	T.
Byrdstown	81	24	52.0	4.78	T.
Carthage †	82	28	54.4	4.73	
Charleston	......	......	......	4.68	
Clarksville	82	28	54.3	3.86	
Clinton †	......	......	......	3.27	
Covington	86	31	58.2	3.96	
Decatur †	80[c]	26[c]	53.6[c]	6.46	
Dover	86	28	55.0	3.84	
Dyersburg	84	28	57.0	4.91	
Elizabethton †	80	21	48.9	4.35	T.
Elk Valley	80	23	51.0	2.59	
Erasmus	79	18	48.5	5.76	T.
Fairmount *[5]	77	24	50.6	6.71	T.
Florence †	79[c]	27[c]	53.4[c]	4.59	
Franklin	80	28	54.0	3.95	
Grace *[1]	80	24	53.7	6.50	
Greeneville †	79	21	50.0	3.04	T.
Harriman	80	28	53.5	4.74	
Hohenwald †	84	27	54.7	5.00	
Jackson †	80	30	56.8	3.33	
Johnsonville	87	26	54.9	2.63	
Jonesboro *[1]	77	20	48.1	3.11	T.
Kingston †	......	......	......	4.88	
Lafayette	......	......	......	4.59	
Liberty †	80	22	53.9	5.74	
Lynnville †	80	29	54.6	5.43	
McKenzie †	83	31	56.0	4.34	
McMinnville †	78	24	52.6	5.66	
Maryville	......	......	......	4.41	
Newmarket *[5]	78	28	52.8	2.74	
Newport †	78	27	52.1	3.09	T.
Nunnelly	83	25	54.3	3.44	
Oak Hill	82	22	52.4	5.58	T.
Palmetto †	80	25	53.9	5.68	
Peryear *[5]	84	31	56.2	3.40	
Pope	85	23	54.6	3.25	
Rogersville †	76	24	50.5	2.82	
Rugby	76	20	48.9	4.38	T.
St. Joseph	83	25	54.3	4.95	
Savannah	84	27	56.0	2.60	
Sewanee †	78	20	50.1	6.67	T.
Silverlake	77	15	45.6	2.70	T.
Springdale	80	23	50.9	2.54	
Sylvia	83	24	54.2	3.31	
Tazewell	......	......	......	3.02	
Tellico Plains †	83	25	53.4	4.77	
Tracy City	78	22	50.0	7.22	T.
Trenton	84	27	55.4	4.59	
Tullahoma †	81	25	52.4	5.60	
Union City	82	26	55.1	4.70	
Waynesboro	84	25	54.5	3.69	
Wildersville	82	28	55.8	4.25	
Yukon	82	27	55.0	4.57	
Texas.					
Anson	......	......	......	1.75	
Arthur City †	......	......	......	0.66	
Austin *a*	87	39	66.0	3.80	
Austin *b* *[5]	86	39	63.9	......	
Ballinger †	94	35	65.4	2.57	
Beeville †	95	43	69.8	2.85	
Blanco †	88	38	63.3	5.85	
Boerne *[1]	88	40	64.8	3.88	
Brazoria †	85	45	66.9	3.93	
Bremond *[1]	84	43	65.6	2.00	
Brenham †	87	43	66.6	2.89	
Brownwood	93	39	62.5	2.55	
Burnet *[1]	84	39	63.0	6.83	
Camp Eagle Pass †	99	45	73.2	1.30	
Childress	98	28	59.8	0.38	
Coleman	86	33	64.4	2.56	
College Station	82	40	65.4	4.69	
Columbia †	86	43	65.6	3.81	
Conroe	86	44	65.6	4.66	
Corsicana *b* †	87	36	63.4	1.71	
Cuero †	88	46	65.2	3.23	
Dallas †	85	34	60.8	2.61	
Danevang †	86	38	65.9	6.26	
Dublin †	89	36	62.0	2.90	
Duval *[1]	92	43	69.8	5.53	
Emory	85	34	60.1	1.29	
Estelle †	89	28	61.2	3.03	
Forestburg	88	32	63.4	1.00	
Fort Clark	94	41	69.7	0.54	
Fort McIntosh	100	46	71.6	1.15	
Fort Ringgold †	101	48	72.5	0.43	
Fort Stockton	......	......	......	0.20	
Fort Worth	87[d]	34[d]	62.6[d]	2.55	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Texas—Cont'd	°	°	°	*Ins.*	*Ins.*
Fredericksburg *†[1]	88	41	64.5	3.68	
Fruitland	88	30	62.0	1.02	
Gainesville	85	33	62.0	2.40	
Grapevine	86	34	62.2	1.91	
Hale Center †	96	26	60.3	0.95	T.
Hallettsville †	88	44	68.4	4.46	
Hewitt	......	......	......	2.45	
Honey Grove	......	......	......	1.61	
Houston †	87	44	66.1	5.92	
Hulen	......	......	......	3.41	
Huntsville †	83	42	64.8	5.00	
Jacksonville	84	37	63.2	1.11	
Jasper	86	37	62.4	3.10	
Kent	......	......	......	1.27	
Kerrville	90	40	63.2	3.98	
Lampasas †	89	38	65.0	3.34	
Llano *†[5]	88	43	66.9	4.40	
Longview †	86	37	63.4	1.24	
Luling †	89	45	67.5	1.76	
Mann	87	38	64.9	1.68	
Marshall	82	36	62.0	1.28	
Menardville	91	34	63.0	2.63	
Midland [1]	98	32	63.4	1.20	
Mount Blanco †	98	25	60.3	0.09	
New Braunfels †	89	46	67.2	2.40	
Panter	......	......	......	3.90	
Paris	88	32	60.0	0.68	
Point Isabel *[1]	88	60	73.2	0.75	
Rheinland †	97	32	64.4	1.55	
Roby	......	30	......	1.84	
Rockport *[1]	83	52	69.8	......	
Rocksprings	......	......	......	1.73	
Runge †	92	47	69.5	3.48	
San Antonio	95	46	70.3	1.65	
San Marcos *b* †	89	42	65.2	2.32	
Sulphur Springs †	92	34	64.8	1.08	
Temple *a*	85	38	65.3	3.93	
Tyler	85	35	62.6	0.87	
Valentine †	92	20	64.6	......	
Victoria	......	......	......	3.17	
Waxahachie †	85	36	62.6	2.50	
Weatherford †	87	34	62.6	3.23	
Wichita Falls †	......	......	......	1.92	
Utah.					
Alpine †	......	......	......	1.24	......
Blue Creek *[5]	78	25	50.4	T.	T.
Brigham †	......	......	......	0.87	......
Cisco †	88	30	56.6	0.20	
Corinne	82	21	52.8	0.47	......
Croydon	84	19	47.7	0.30	3.0
Ferron	86	27	50.8	0.85	T.
Fillmore †	91	18	52.4	0.59	
Fort Duchesne †	85	24	49.6	0.17	
Frisco	83	22	53.2	0.41	2.0
Giles †	95	23	56.8	0.46	
Heber	82	20	47.2	1.25	0.5
Huntsville	......	......	......	0.99	T.
Kelton *[5]	80	30	50.5	1.25	
Levan †	86	20	50.5	1.06	
Loa †	79	8	43.2	0.45	T.
Logan †	78	27	51.5	1.58	
Millville	......	......	......	0.80	......
Minersville	85	25	53.6	0.25	
Moab †	95	25	59.5	0.25	
Mount Pleasant †	95	24	53.2	1.15	4.0
Ogden *a* *[5]	84	32	55.5	0.37	0.4
Pahreah	90	33	56.8	0.60	
Parowan †	84	23	52.6	0.64	2.2
Pinto	79	18	48.4	0.39	
Promontory *[5]	74	16	42.7	0.02	0.2
Provo	86	22	54.0	0.72	
Richfield †	80	20	48.1	0.15	
St. George †	98	30	63.0	0.60	
Scipio †	86	16	49.2	0.35	
Snowville	80	18	49.0	0.76	
Soldier Summit	85	15	42.6	1.56	13.8
Terrace *[5]	71	28	45.5	1.00	
Thistle	83	12	47.6	0.00	
Tooele †	83	25	52.7	1.21	
Tropic	78	14	46.2	0.88	1.0
Vernal	82	23	51.0	0.50	
Vermont.					
Bennington	68	14	43.6	2.69	0.0
Brattleboro	72	20	43.2	4.13	3.5
Burlington †	64	19	43.6	2.33	T.
Chelsea †	63	6	38.1	2.65	5.0
Cornwall	70	15	44.3	1.89	......
Enosburg Falls	68	6	40.0	1.58	1.0
Hartland †	70	11	40.5	3.42	1.6
Jacksonville	60	11	36.8	4.16	5.0
Norwich	69	9	40.6	3.03	2.0
St. Johnsbury	64	9	40.2	2.45	3.9
Vernon *[5]	68	17	43.7	3.70	3.0
Wells	64	10	39.9	2.58	T.
Woodstock	68	10	40.8	3.51	3.5

TABLE II.—*Meteorological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Virginia.	°	°	°	*Ins.*	*Ins.*
Alexandria	83	27	51.3	2.65	0.7
Ashland †	86	24	53.4	5.09	T.
Ballsville	87[e]	27[e]	54.2[e]	4.57	
Barboursville	85	24	51.8	3.19	T.
Bedford City	88	23	53.5	3.21	T.
Bigstone Gap †	82	23	50.6	2.56	T.
Birdsnest * † 1	85	34	53.8	7.75	T.
Blacksburg	80	17	46.8	1.96	0.1
Buckingham †	85	23	50.8	3.20	T.
Burkes Garden	......	......	......	2.73	T.
Callaville †	83	27	53.0	4.19	
Charlottesville	83	25	52.4	3.16	
Christiansburg	......	......	......	1.93	
Clarksville	......	......	......	1.80	
Clifton Forge	81	21	49.8	2.58	T.
Dale Enterprise †	84	12	45.8	2.91	2.0
Danville	......	......	......	2.43	
Doswell	88	23	51.6	5.23	T.
Dwale	......	......	......	1.90	0.5
Farmville	85	27	53.4	4.23	
Fredericksburg †	86	24	52.3	4.28	T.
Grahams Forge	80	20	48.0	1.92	T.
Guinea	......	......	......	2.17	
Hampton	83	31	54.7	8.15	
Leesburg	......	......	......	1.89	0.8
Lexington †	82	20	49.2	2.59	T
Maidens	......	......	......	5.41	
Manassas †	85	24	51.4	1.56	1.0
Marion	78	18	47.5[e]	2.08	T.
Miller School	85	24	52.4	3.08	
Petersburg †	86	30	53.6	4.90	T.
Radford	......	......	......	1.69	T.
Richmond (near) †	88	25	54.4	4.71	1.0
Rockymount †	85	25	53.6	2.58	
Salem †	82	25	52.6	1.99	T.
Speers Ferry	......	......	......	3.95	
Spottsville †	85	29	52.8	6.37	0.5
Stanardsville †	83	19	50.2	3.24	T.
Staunton †	85	19	50.0	2.95	3.0
Stephens City †	86[e]	20[e]	50.0[e]	2.13	3.0
Sunbeam †	84	28	53.5	4.50	
Warrenton	81	27	52.5	5.00	1.5
Warsaw †	83	25	50.8	4.18	T.
Westbrook Farm	83	27	50.6	......	T.
Westpoint	89	19	51.4	5.43	T.
Woodstock †	85	21	50.2	2.75	1.5
Wytheville †	81	19	48.9	2.19	0.5
Washington.					
Aberdeen	75	29	49.4	4.93	
Anacortes	......	......	......	1.04	
Ashford †	......	......	......	3.79	T.
Blaine †	73	20	44.5	2.17	
Bridgeport	81	27	55.0	T.	
Centerville †	77	20	47.8	0.29	
Clearwater	72	31	48.0	8.44	
Colfax	78[d]	26[d]	49.4[d]	0.68	
Coupeville †	73	31	50.3	1.61	
Dayton	80	31	52.4	0.86	
Ellensburg	74	19	47.7	0.03	
Ellensburg (near)	74	22	48.8	0.03	
Fort Simcoe †	81	30	53.8	0.02	
Fort Spokane	76	24	49.7	0.25	
Grandmound †	82	28	49.2	2.63	
Hunters †	70	22	42.8	1.12	2.0
Kennewick †	82	29	54.8	0.21	
Lacenter	81	30	50.4	2.76	
Lakeside	72	32	53.2	T.	
Lapush	62	31	44.5	6.65	
Lind	85	24	52.4	0.28	
Loomis †	78	31	52.4	0.16	
Madrone †	76	29	49.2	2.14	
Mayfield †	81[g]	29[g]	49.6[g]	3.60	
Moxee Valley †	84	24	50.8	0.10	
New Whatcom	73	29	48.0	1.87	
Olga	65	34	47.4	1.22	
Olympia †	85	28	49.2	2.10	
Orcas Island	68	32	49.0	0.80	
Pinehill †	75	25	50.2	0.33	
Pomeroy	81	34	53.7	0.62	
Port Townsend	63	35	48.2	1.36	
Pullman †	75	29	48.0	1.02	
Rosalia †	75	29	47.3	0.68	0.2
Sedro †	78	31	52.2	3.35	
Shoalwater Bay * 10	70	36	49.4	......	
Snohomish †	78	32	51.6	2.46	
Southbend	77	29	48.6	4.94	
Stampede	65	23	43.1	2.49	1.0
Stillaguamish	76[e]	27[e]	46.6[e]	1.86	
Sunnyside †	84	25	52.3	0.05	
Union City †	76	31	49.7	3.40	
Vashon †	78	30	48.6	1.63	
Waterville †	73	25	46.8	0.06	

Stations	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
West Virginia.	°	°	°	*Ins.*	*Ins.*
Beckley	72	14	44.7	2.00	1.0
Beverly †	80	9	44.4	3.44	9.0
Buckhannon *a* †	......	......	......	4.45	2.5
Buckhannon *b*	80	5	48.9	......	......
Burlington †	82	13	47.2	3.73	3.0
Charleston †	......	......	......	2.72	1.0
Dayton †	81	2	48.8	2.93	3.0
Eastbank	86	20	52.6	3.36	0.8
Elkhorn †	80	19	48.6	3.76	T.
Fairmont †	......	......	......	4.40	4.5
Glenville †	80	11	47.8	3.02	3.0
Grafton †	80	9	46.2	4.05	4.9
Green Sulphur	83	20	48.0	1.85	
Harpers Ferry	......	......	......	1.87	2.5
Hinton *a* †	......	......	......	2.30	1.0
Hinton *b* †	82	25	49.8	......	......
Huntington	81	15	51.0	1.40	......
Kingwood	74	14	44.7	4.28	3.1
Marlinton †	77	14	43.9	4.32	2.5
Martinsburg †	81	21	48.3	1.87	2.0
Morgantown *b* †	80	8	46.8	4.86	3.4
New Cumberland	84	20	49.2	......	
New Martinsville	79	19	49.1	3.53	1.0
Nuttallburg	79	11	45.2	......	......
Oldfields †	81	12	46.9	2.37	0.8
Philippi	80	9	49.1	4.31	4.3
Point Pleasant †	84	21	51.4	1.48	2.0
Powellton	82	20	49.8	2.68	0.1
Romney	79	21	48.8	2.53	2.0
Rowlesburg †	......	......	......	4.77	4.0
Upper Tract	81	9	46.4	3.16	2.5
Weston *a*	......	......	......	3.11	3.0
Weston *b* * † 1	78	10	47.6	......	6.7
Wheeling *a* †	......	......	......	3.72	3.1
Wheeling *b* †	84	22	52.0	3.62	1.0
White Sulphur Springs	80	13	47.2	3.07	2.5
Wisconsin.					
Amherst	74	13	44.0	2.75	8.0
Antigo	69	11	40.2	1.61	11.9
Barron	65	10	37.8	1.02	0.2
Bayfield	64	12	39.9	0.40	1.0
Beloit	79	21	45.8	2.65	
Brodhead	84	20	45.8	2.59	
Butternut	77	5	42.8	0.83	2.5
Chilton	75	19	44.0	2.31	4.5
Citypoint	69	20	46.1	4.47	4.0
Delavan	79	20	44.2	1.96	T.
Dodgeville †	78	16	45.0	3.10	
Easton	77	12	43.0	3.25	1.5
Eau Claire	72	16	43.6	2.22	T.
Florence †	70	4	39.3	1.56	9.8
Fond du Lac	76	20	44.2	2.40	0.5
Grand River Locks	......	......	......	2.78	1.0
Grantsburg †	70	9	42.6	1.64	
Gratiot	80	19	44.0	2.20	
Hartford	......	......	......	0.54	0.5
Hartland	78	20	44.0	2.34	
Harvey	76	19	45.3	2.44	0.8
Hayward	71	10	43.8	0.56	2.0
Heafford Junction * 1	68	12	41.4	1.93	4.0
Hillsboro	78	......	......	1.53	......
Kenosha * 10	70	18	39.3	......	......
Knapp	74	15	43.4	1.23	1.2
Koepenick * † 1	66	18	39.3	1.70	9.0
Lancaster †	79	16	45.2	2.77	
Madison †	74	22[e]	45.3	2.46	
Manitowoc †	67	21	42.0	2.24	3.0
Meadow Valley †	77	14	43.0	3.19	1.5
Medford †	71	5	40.2	1.65	4.5
Menasha	......	......	......	2.50	4.0
Neillsville	74	14	43.4	4.51	5.0
New Holstein	67	20	45.0	1.25	2.0
New London	76	15	43.1	2.98	4.0
North Crandon	......	......	......	1.56	12.1
Oconto	72	14	43.5	2.82	3.5
Osceola †	74	4	42.2	1.63	3.0
Oshkosh	......	......	......	4.30	3.0
Pepin	74	12	43.4	1.38	2.0
Pine River †	77	12	43.8	2.80	4.5
Portage †	78	12	43.4	2.14	T.
Port Washington	79	20	43.1	2.59	
Prairie du Chien	82	18	48.2	2.55	
Racine	83	22	44.2	1.54	T.
Sharon	......	......	......	2.24	
Shawano	75	12	42.8	2.04	11.0
Sheboygan * 10	59	24	42.6	......	......
Spooner	73	11	42.6	0.49	4.0
Stevens Point †	75	11	43.5	1.94	6.0
Sturgeon Bay Canal * 10	60	16	38.9	......	......
Two Rivers * 10	55	24	41.9	......	......
Valley Junction †	75	12	43.7	4.43	1.0
Viroqua	75	15	44.6	4.15	T.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Wisconsin—Cont'd.	°	°	°	*Ins.*	*Ins.*
Watertown †	78	20	44.0	2.50	0.5
Waukesha †	78	20	44.6	2.05	0.2
Waupaca †	75	14	43.9	2.61	4.0
Wausau †	68	12	40.6	1.61	2.5
Westbend	78	20	43.7	2.55	0.2
Westfield †	76	14	43.6	2.71	
Whitehall	73	15	44.2	3.10	3.0
White Mound †	81	15	45.3	3.07	
Wyoming.					
Atlantic City	69	10	37.6	1.65	16.5
Big Horn Ranch	73	0	39.7	0.45	7.0
Carbon	85	10	45.4	2.03	0.4
Embar	80	17	47.2	......	......
Fort Laramie †	90	12	48.4	0.75	3.0
Fort Washakie	79	17	45.2	0.87	3.5
Fort Yellowstone †	68	6	40.5	0.95	6.5
Laramie	74	2	40.4	1.26	......
Lovell	85	13	47.2	0.15	T.
Lusk †	85	14	43.6	1.02	
Otto	88	12	46.5	0.25	
Sheridan	84	6	39.8	1.11	3.0
Sundance	76	8	40.9	1.12	3.0
Wamsutter	......	......	......	1.25	
Wheatland	88	18	49.3	0.32	0.5
Mexico.					
Ciudad P. Diaz	92	50	72.5	1.54	
Leon de Aldamas	88	48	68.4	0.46	
Puebla	82	40	61.2	1.03	
Topolobampo * 1	84[i]	63	72.1[i]	0.00	
New Brunswick.					
St. Johns	59	23	38.8	5.40	4.0

Late reports for March, 1898.

Alaska.					
Killisnoo	44	17	32.4	2.45	3.5
Arkansas.					
Newport *b.*	80[e]	25[e]	53.0[e]	4.32	
California.					
Edmanton * 1	65	15	37.5	1.41	13.0
Fort Tejon	......	......	......	1.36	
Goshen * 1	80	25	51.7	0.44	
Kernville	......	......	......	0.35	
San Miguel Island	70	38	53.6	0.39	
Ukiah	74	24	47.7	0.68	
Yuba City * 5	71	28	51.8	T.	
Georgia.					
Mount Vernon	85	42	62.4	......	......
Maryland.					
Laurel	......	......	......	2.54	1.5
Michigan.					
Stanton	64	3	36.0	......	......
Missouri.					
Humansville	75	20	46.4	5.12	
Unionville	62	16	38.5	4.44	0.5
Montana.					
Adel [e]	51	−37	18.8	3.57	35.7
Augusta	65	−34	20.1	2.28	15.1
Nebraska.					
Sargent	......	......	......	0.22	3.0
Nevada.					
Elko	......	......	......	0.20	2.0
Hot Springs * 1	65	30	42.9	......	......
Wadsworth * 1	68	8	33.6	......	......
Oregon.					
Comstock * 5	70	22	42.6	2.40	
West Fork * 5	68	26	41.6	2.61	4.0
Wisconsin.					
Knapp	......	......	......	0.87	1.7
Medford	......	......	......	2.20	15.0
New Brunswick.					
St. John	52	17	34.0	4.74	8.4

CORRECTIONS.

California, Santa Barbara (*a*) February, 1898, make precipitation read 1.39 instead of 0.97. Milton (near) March, 1898, strike out all data and enter 76, 30, 52.2, 0.92.

Washington, Olga, March, 1898, make precipitation read 3.22 instead of 3.12. Snohomish, March, 1898, make maximun and mean temperature read 58 and 43.2 instead of 71 and 43.7.

Wisconsin, Medford, January, 1898, make precipitation read 0.20 and snowfall 2.0. Grantsburg, February, 1898, make precipitation read 0.88 instead of 0.45.

NOTE.—The following changes have been made in names of stations:

North Dakota, Grand Rapids, changed to Berlin, and Falconer to Washburn.

Wisconsin, Somo, changed to Heafford Junction.

TABLE III.—*Data furnished by the Canadian Meteorological Service, April, 1898.*

Stations.	Pressure. Mean not reduced.	Mean reduced.	Departure from normal.	Temperature. Mean.	Departure from normal.	Mean maximum.	Mean minimum.	Precipitation. Total.	Departure from normal.	Depth of snow.	Stations.	Pressure. Mean not reduced.	Mean reduced.	Departure from normal.	Temperature. Mean.	Departure from normal.	Mean maximum.	Mean minimum.	Precipitation. Total.	Departure from normal.	Depth of snow.
	Ins.	Ins.	Ins.	°	°	°	°	Ins.	Ins.			Ins.	Ins.	Ins.	°	°	°	°	°	Ins.	
St. Johns, N. F.	29.70	29.85	-.03	35.3	+ 0.8	41.7	28.8	3.26		4.5	Saugeen, Ont.	29.32	30.05	+.05	39.1	+ 0.4	47.5	30.8	0.77	-1.06	1.0
Sydney, C. B. I.	29.85	29.89	+.02	36.9	+ 1.9	44.9	28.9	5.36	+1.56	6.0	Parry Sound, Ont	29.34	30.05	+.07	30.7	+ 2.1	51.7	27.7	1.20	-0.52	2.2
Halifax, N. S.	29.78	29.91	+.03	40.0	+ 2.2	47.1	32.9	7.10	+3.79	3.6	Port Arthur, Ont.	29.38	30.09	+.07	35.5	+ 2.0	45.7	25.2	0.07	-1.30	0.0
Grand Manan, N. B.	29.84	29.89	-.09	39.0	- 0.2	45.1	32.8	5.77	+2.37	9.7	Winnipeg, Man.	29.21	30.05	+.02	38.3	+ 2.4	51.3	25.2	0.98	-0.37	0.0
Yarmouth, N. S.	29.81	29.89	-.02	39.8	+ 0.9	46.9	32.8	4.32	+1.38	10.9	Minnedosa, Man.	28.22	30.07	+.09	36.6	+ 0.6	49.6	23.7	0.18	-0.94	0.0
Charlottet'n, P. E. I.	29.84	29.88	-.08	37.4	+ 2.2	43.3	31.6	4.98	+2.06	2.5	Qu'Appelle, Assin.	27.74	30.04	+.08	35.4	- 2.0	45.6	25.2	0.92	-0.14	2.4
Chatham, N. B.	29.89	29.91	-.01	35.6	+ 0.1	44.6	26.6	5.25	+2.15	19.8	Medicine Hat, Assin.	27.68	29.99	+.07	41.9	- 2.6	54.2	29.7	1.42	+0.91	2.1
Father Point, Que.	29.91	29.94	+.03	33.1	- 0.1	41.0	25.3	2.12	+0.10	8.8	Swift Current, Assin	27.43	30.06	+.06	36.4	- 4.9	45.8	27.0	0.60	-0.58	5.6
Quebec, Que.	29.62	29.96	+.01	38.6	+ 3.5	47.3	29.9	1.30	-1.09	2.0	Calgary, Alberta	26.40	29.98	+.06	38.2	- 1.4	50.0	26.4	0.29	-0.33	2.7
Montreal, Que.	29.75	29.96	.00	42.5	+ 2.8	51.6	33.4	1.16	-1.28	1.6	Banff, Alberta	25.32	30.02	......	36.6	......	46.9	26.4	0.81	......	5.8
Rockliffe, Ont	29.48	30.00	+.04	40.9	+ 3.4	55.1	26.7	0.53	-0.71	0.1	Edmonton, Alberta	27.62	29.94	+.03	39.9	0.0	51.6	28.2	0.04	-0.53	T.
Ottawa, Ont	29.66	30.02	......	43.4	+ 3.4	54.9	31.8	0.75	......	2.0	Prince Albert, Sask.	28.40	29.94	......	35.7	- 0.4	47.5	24.0	0.06	......	0.6
Kingston, Ont	29.66	29.98	+.01	43.6	+ 3.6	53.6	33.6	1.28	-0.67	2.8	Battleford, Sask.	28.26	30.04	......	34.9	- 2.3	46.0	23.8	0.02	......	T.
Toronto, Ont	29.63	30.02	+.03	44.0	+ 3.2	52.9	35.0	1.70	-0.18	0.5	Kamloops, B. C.	28.71	29.99	......	50.4	......	62.6	38.2	T.	......	0.0
White River, Ont.	28.75	30.14	+.08	32.7	- 0.3	48.1	17.2	0.05	-0.87	T.	Esquimalt, B. C.	30.05	30.08	......	47.2	+ 0.7	55.6	38.8	0.89	......	0.0
Port Stanley, Ont	29.38	30.03	+.02	42.1	+ 1.1	52.3	31.9	2.34	+0.21	2.4	Hamilton, Bermuda	29.93	30.09	+.04	64.8	+ 0.9	70.3	59.3	8.65	......	

TABLE IV.—*Mean temperature for each hour of seventy-fifth meridian time, April, 1898.*

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
Bismarck, N Dak.	39.4	38.4	37.3	36.2	35.3	34.5	33.8	33.8	36.5	40.3	44.1	46.7	48.6	50.3	51.7	52.6	53.1	52.9	52.2	50.2	47.1	44.4	42.3	41.2	43.5
Boston, Mass.	40.6	40.0	39.6	39.1	38.6	38.6	39.7	41.3	42.9	43.2	45.5	46.8	47.5	48.4	48.2	48.1	47.6	47.1	45.4	44.3	43.9	43.0	42.4	41.8	43.5
Buffalo, N. Y.	40.7	40.5	39.7	39.5	39.1	38.7	38.9	40.1	41.9	43.3	44.5	46.1	47.1	47.1	47.2	47.3	46.9	46.5	45.4	44.6	43.4	42.6	41.9	41.9	43.1
Chicago, Ill.	42.9	42.4	41.8	41.5	41.2	40.9	40.5	41.8	42.8	44.1	44.8	45.6	46.5	46.8	46.9	47.2	46.4	46.5	45.8	45.5	44.7	44.2	43.8	43.8	44.1
Cincinnati, Ohio	48.7	47.9	47.0	46.4	45.3	44.3	43.5	45.4	46.8	49.2	51.5	53.8	55.2	56.0	57.1	57.6	57.6	57.3	56.1	55.3	54.5	53.2	51.9	50.5	51.3
Cleveland, Ohio	42.4	42.1	41.3	40.9	40.6	40.1	40.3	41.3	42.3	42.8	43.8	44.3	44.8	45.2	45.6	46.4	46.8	47.4	47.2	46.0	45.5	44.8	44.2	43.5	43.7
Detroit, Mich.	41.8	41.5	40.9	40.3	39.4	38.9	38.7	40.9	43.0	45.2	47.2	48.7	50.4	51.0	51.5	51.8	51.2	50.3	48.8	47.6	46.3	45.4	44.4	43.7	45.4
Dodge City, Kans.	48.6	47.4	46.3	45.6	44.5	43.4	42.6	42.9	46.5	51.2	55.1	58.1	60.1	62.4	64.5	66.2	66.4	66.3	64.9	61.4	57.7	54.7	52.6	50.8	54.2
Eastport, Me.	35.2	35.0	34.4	34.2	33.9	33.8	34.4	35.5	36.9	39.0	39.0	40.1	41.1	41.5	41.8	41.7	41.5	40.5	39.4	38.6	38.0	37.5	36.8	36.3	37.7
Galveston, Tex.	65.5	65.3	65.0	64.8	64.5	64.2	64.3	64.9	65.5	66.5	67.8	68.7	69.3	70.2	71.0	71.1	71.1	70.5	69.8	68.9	68.0	67.6	67.0	66.3	67.4
Havre, Mont.	40.0	38.7	37.7	36.9	35.9	34.9	34.0	33.0	33.5	35.7	38.9	42.0	44.7	46.4	48.1	49.0	50.0	50.7	50.6	49.5	47.9	45.9	43.4	42.1	42.1
Kansas City, Mo.	51.1	50.1	48.8	48.0	47.2	46.5	46.1	46.4	48.8	51.1	53.9	56.0	57.6	58.8	59.8	60.1	60.5	60.5	59.5	58.2	56.3	55.0	53.8	52.8	53.6
Key West, Fla.	73.5	73.4	73.0	72.8	72.6	72.6	73.2	74.3	75.6	76.4	76.5	77.3	77.9	78.1	77.6	77.4	76.9	76.1	75.3	74.6	74.3	74.2	73.8	73.8	75.1
Memphis, Tenn.	56.4	55.6	54.6	53.6	52.7	52.1	51.8	52.3	53.8	56.0	58.1	60.1	61.5	62.4	63.8	64.7	65.0	65.0	64.3	63.3	62.0	60.8	59.8	58.5	58.7
New Orleans, La.	61.6	61.2	60.5	60.0	59.1	58.5	58.3	59.7	61.7	64.5	66.2	67.7	69.1	70.4	71.0	71.5	71.9	71.2	69.7	68.1	65.9	64.6	63.3	62.4	64.9
New York, N. Y.	43.1	42.4	41.5	41.2	40.8	40.5	41.0	42.9	44.2	45.7	47.2	49.0	50.1	51.3	51.9	51.9	50.8	49.5	48.1	47.6	46.7	46.1	45.3	44.8	46.0
Philadelphia, Pa.	45.3	44.7	44.4	43.7	43.1	43.0	43.9	46.1	47.8	49.8	51.6	53.5	55.0	55.8	56.1	55.6	55.3	54.1	52.5	51.3	49.5	48.4	47.7	46.8	49.4
Pittsburg, Pa.	45.7	44.3	43.5	42.8	42.4	41.9	41.6	43.0	44.8	46.9	48.7	50.2	51.6	52.9	54.1	54.8	55.0	54.7	53.6	52.5	51.1	49.9	48.7	47.5	48.4
Portland, Oreg.	50.4	49.4	48.3	47.3	46.6	45.7	44.8	45.0	43.6	44.3	45.7	48.8	50.7	52.7	54.3	56.0	57.3	58.2	59.0	58.3	57.7	56.1	54.0	52.1	51.1
St. Louis, Mo.	51.6	50.7	50.0	49.5	48.7	48.2	48.1	49.2	51.0	52.0	54.1	56.1	57.3	58.5	59.7	60.3	60.2	59.9	58.4	57.2	55.8	55.2	54.2	53.3	54.1
St. Paul, Minn.	42.6	41.4	40.3	39.4	38.5	37.8	37.4	38.0	39.7	42.7	45.5	47.7	49.4	50.5	51.6	52.3	52.9	53.3	52.9	51.3	49.6	48.0	46.1	44.8	45.6
Salt Lake City, Utah.	51.1	49.6	48.2	46.8	45.5	44.8	44.1	45.4	45.8	49.1	53.3	56.7	58.8	60.5	61.9	63.1	63.6	63.6	63.4	62.9	60.2	56.7	54.3	52.8	54.3
San Diego, Cal.	56.5	56.5	55.6	55.2	54.8	54.6	54.4	54.5	54.4	55.1	57.0	59.5	61.8	62.3	63.0	63.1	63.6	63.1	62.5	61.8	60.2	59.2	58.3	57.4	58.5
San Francisco, Cal.	51.3	51.0	50.3	49.9	49.5	49.4	49.1	49.1	48.7	49.3	51.1	52.9	55.6	57.3	58.6	59.3	59.4	59.2	58.1	56.5	54.8	53.8	52.2	51.8	53.3
Savannah, Ga.	58.9	58.1	57.2	56.3	55.6	54.7	55.5	58.0	62.2	65.2	67.7	69.8	71.1	71.9	71.9	71.0	69.7	67.9	65.3	63.7	62.3	61.1	60.3	59.7	63.1
Washington, D. C.	46.6	45.6	44.7	44.2	43.4	43.2	44.4	47.2	49.4	51.5	53.6	55.3	56.5	57.0	57.7	57.8	57.2	56.2	54.8	53.4	51.4	50.1	49.2	48.5	50.8

TABLE V.—*Mean pressure for each hour of seventy-fifth meridian time, April, 1898.*

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
Bismarck, N. Dak.	28.272	.277	.276	.274	.276	.279	.284	.286	.285	.289	.272	.266	.256	.244	.233	.227	.220	.219	.224	.229	.237	.249	.256	.260	.257
Boston, Mass.	29.794	.784	.784	.782	.789	.798	.802	.806	.805	.802	.794	.785	.777	.771	.766	.765	.769	.775	.788	.801	.805	.805	.805	.803	.790
Buffalo, N. Y.	29.158	.150	.145	.146	.150	.158	.170	.176	.177	.177	.173	.165	.160	.150	.142	.136	.141	.143	.150	.158	.164	.163	.161	.162	.157
Chicago, Ill.	29.183	.179	.177	.177	.181	.185	.194	.204	.206	.206	.205	.199	.194	.184	.177	.167	.163	.161	.160	.160	.173	.177	.176	.173	.182
Cincinnati, Ohio	29.378	.375	.369	.375	.377	.386	.399	.408	.410	.411	.409	.401	.389	.376	.361	.350	.348	.348	.349	.354	.361	.367	.370	.373	.377
Cleveland, Ohio	29.193	.190	.188	.191	.195	.205	.216	.218	.220	.221	.219	.212	.207	.199	.188	.182	.178	.178	.185	.191	.198	.196	.194	.193	.198
Detroit, Mich.	29.249	.246	.241	.238	.242	.246	.258	.265	.266	.267	.264	.255	.247	.241	.230	.226	.226	.229	.232	.240	.251	.250	.249	.247	.246
Dodge City, Kans.	27.434	.438	.438	.438	.438	.440	.448	.460	.465	.462	.463	.458	.446	.425	.406	.386	.370	.364	.368	.377	.383	.397	.411	.417	.422
Eastport, Me.	29.774	.771	.768	.768	.774	.784	.794	.802	.807	.808	.802	.795	.787	.782	.778	.776	.778	.782	.790	.796	.797	.795	.792	.789	.787
Galveston, Tex.	30.036	.033	.027	.023	.025	.029	.040	.049	.057	.061	.067	.067	.056	.046	.029	.014	.001	.996	.990	.991	.004	.019	.031	.034	.030
Havre, Mont.	27.364	.364	.361	.358	.359	.363	.368	.371	.377	.379	.379	.380	.374	.366	.360	.355	.348	.343	.341	.339	.341	.350	.359	.358	.361
Kansas City, Mo.	29.075	.075	.072	.074	.073	.079	.088	.096	.105	.105	.107	.101	.089	.074	.059	.042	.027	.022	.024	.025	.038	.050	.057	.059	.067
Key West, Fla.	30.018	.070	.061	.057	.059	.068	.078	.086	.098	.107	.110	.101	.090	.071	.056	.042	.034	.032	.048	.064	.077	.085	.090	.088	.073
Memphis, Tenn.	29.661	.656	.650	.651	.654	.659	.674	.686	.694	.700	.707	.702	.684	.672	.653	.639	.627	.624	.620	.624	.637	.644	.648	.653	.659
New Orleans, La.	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
New York, N. Y.	29.615	.609	.608	.600	.601	.608	.618	.622	.623	.622	.616	.606	.596	.585	.575	.572	.573	.580	.589	.603	.618	.620	.620	.621	.604
Philadelphia, Pa.	29.848	.841	.841	.839	.841	.846	.857	.864	.866	.866	.856	.843	.831	.819	.809	.806	.808	.810	.824	.837	.848	.851	.850	.852	.840
Pittsburg, Pa.	29.124	.118	.111	.110	.114	.122	.135	.144	.145	.146	.141	.136	.124	.112	.103	.090	.088	.092	.097	.107	.118	.121	.121	.121	.118
Portland, Oreg.	29.948	.951	.955	.955	.956	.956	.955	.954	.961	.970	.974	.977	.979	.976	.966	.958	.950	.937	.929	.919	.915	.916	.926	.936	.951
St. Louis, Mo.	29.464	.459	.456	.456	.461	.468	.479	.490	.495	.497	.498	.492	.479	.466	.449	.436	.423	.423	.426	.430	.441	.449	.451	.452	.460
St. Paul, Minn.	29.163	.167	.165	.165	.169	.172	.181	.189	.195	.194	.193	.188	.176	.166	.156	.146	.134	.126	.122	.118	.123	.131	.134	.138	.159
Salt Lake City, Utah	25.658	.659	.662	.659	.659	.660	.661	.670	.681	.690	.691	.691	.686	.676	.659	.648	.630	.620	.612	.611	.607	.617	.628	.635	.653
San Diego, Cal.	29.908	.907	.908	.896	.885	.878	.876	.877	.886	.899	.907	.912	.915	.912	.903	.894	.881	.869	.862	.864	.866	.875	.886	.896	.890
San Francisco, Cal.	29.913	.913	.919	.917	.909	.907	.905	.907	.917	.928	.934	.937	.943	.934	.918	.910	.894	.881	.872	.866	.865	.868	.886	.897	.906
Savannah, Ga.	29.968	.961	.958	.962	.969	.990	.001	.008	.011	.011	.007	.992	.967	.955	.939	.930	.927	.929	.942	.953	.964	.969	.971	.974	.969
Washington, D. C.	29.876	.867	.864	.865	.872	.881	.891	.894	.896	.895	.888	.873	.865	.853	.839	.834	.839	.843	.849	.863	.874	.875	.873	.877	.869

TABLE VI.—*Average wind movement for each hour of seventy-fifth meridian time, April, 1898.*

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
Abilene, Tex	12.1	11.7	10.0	10.8	10.3	10.8	10.2	10.0	11.6	13.4	14.4	14.4	14.9	14.6	14.7	15.3	15.2	15.0	14.7	14.9	12.2	11.5	11.8	11.9	12.8
Albany, N. Y	6.3	6.0	6.3	5.6	5.8	5.6	6.2	7.0	8.1	9.2	10.0	10.6	10.9	11.3	11.3	10.7	10.5	10.5	9.5	8.4	7.3	6.9	6.8	6.7	8.2
Alpena, Mich	8.6	8.6	8.2	8.3	8.2	7.7	7.7	8.9	10.0	10.6	11.1	11.8	12.9	13.8	14.2	13.6	13.0	11.4	10.3	8.7	7.9	7.6	7.6	8.3	10.0
Amarillo, Tex	19.9	18.5	17.6	17.7	17.1	16.6	16.8	16.9	16.3	19.8	22.1	22.2	22.2	21.8	21.0	22.6	22.6	21.8	20.7	20.4	17.9	16.7	18.0	19.0	19.4
Atlanta, Ga	9.3	9.1	9.2	8.9	9.1	8.7	8.7	8.4	8.9	9.2	10.4	11.2	11.9	12.4	12.5	12.7	13.0	12.0	10.2	9.2	9.1	9.2	9.3	9.6	10.1
Atlantic City, N. J	13.1	12.2	12.6	12.5	12.5	12.6	13.0	14.7	15.9	16.8	16.5	16.9	17.6	17.5	17.2	16.6	16.9	15.7	13.9	12.2	11.8	12.1	12.2	13.2	14.4
Augusta, Ga	4.2	4.5	4.8	4.6	4.7	4.8	4.9	5.7	7.2	7.5	8.5	9.7	9.9	9.7	9.8	10.1	10.2	9.2	7.5	5.6	4.6	4.3	4.0	3.8	6.7
Baker City, Oreg	5.1	5.9	6.8	7.1	7.0	7.6	7.2	7.6	8.1	8.0	6.8	6.5	7.3	8.0	9.0	10.4	10.6	11.2	10.8	10.3	9.7	8.3	5.8	5.6	7.9
Baltimore, Md	4.7	5.1	5.1	5.1	5.2	4.8	5.4	6.5	8.3	9.0	9.3	8.9	9.3	9.9	9.4	8.8	8.4	7.7	6.3	5.3	5.1	4.5	4.7	4.6	6.7
Bismarck, N. Dak	10.2	9.4	10.0	9.9	10.1	9.1	9.2	8.8	10.2	12.2	14.3	15.4	16.0	16.1	16.1	17.6	18.8	18.9	18.5	17.2	13.0	10.9	10.9	10.6	13.5
Block Island, R. I	17.6	17.6	17.8	17.9	19.5	20.1	20.2	20.7	19.8	20.0	20.6	20.5	20.9	21.0	21.0	20.3	19.4	19.6	19.2	18.7	17.7	17.3	17.7	17.2	19.3
Boston, Mass	11.6	11.5	11.3	11.7	11.7	11.4	12.3	12.7	13.4	14.1	13.9	14.2	14.4	14.6	15.0	14.5	14.7	14.0	12.8	12.0	11.8	11.8	11.7	11.8	12.9
Buffalo, N. Y	12.6	12.9	12.6	13.1	13.0	12.5	12.9	13.1	14.2	15.0	15.3	15.2	15.9	16.8	18.3	18.2	18.3	16.5	15.0	14.0	13.9	13.6	13.1	12.5	14.5
Cairo, Ill	7.9	7.8	8.0	8.0	8.6	9.2	9.5	9.5	10.6	10.9	11.7	11.8	12.9	13.3	13.3	13.8	13.6	12.7	11.8	10.4	10.0	9.0	8.9	8.6	10.5
Cape Henry, Va	15.2	16.9	16.8	16.9	16.7	15.9	15.7	16.7	17.2	16.9	16.8	16.2	16.9	16.6	16.3	15.9	16.9	15.4	13.9	14.0	15.4	15.8	15.7	14.6	16.0
Carson City, Nev	7.8	7.5	6.3	6.2	5.4	5.1	4.5	4.3	3.6	3.1	3.8	5.4	7.1	8.2	10.1	12.3	13.1	13.2	14.1	13.4	12.3	12.0	9.5	7.5	8.2
Charleston, S. C	11.0	10.2	10.1	9.7	10.1	10.0	10.0	10.3	11.5	11.9	11.6	12.8	14.0	14.2	14.7	14.7	14.0	12.4	11.1	10.7	10.1	10.6	10.6	10.7	11.5
Charlotte, N. C	7.1	6.7	6.4	6.3	6.0	5.9	5.4	5.9	8.0	8.8	9.2	9.9	9.8	10.6	10.2	10.4	9.2	8.0	6.5	6.1	6.7	6.7	6.5	6.8	7.6
Chattanooga, Tenn	5.8	5.5	5.9	5.9	5.6	5.1	6.0	6.8	6.7	8.1	9.8	10.2	10.5	10.5	11.3	10.9	11.1	10.9	10.4	8.6	7.0	6.0	5.2	5.4	7.9
Cheyenne, Wyo	8.8	7.6	7.3	7.4	7.3	7.6	7.8	7.7	9.0	11.2	13.9	13.8	15.5	15.9	16.8	16.7	17.0	16.6	16.2	15.2	12.3	9.2	8.9	9.1	11.6
Chicago, Ill	18.5	17.7	17.9	17.6	18.3	19.2	19.4	18.8	18.4	18.7	19.1	19.9	20.6	19.4	19.3	19.3	20.2	19.4	19.3	18.7	18.6	17.2	16.8	17.0	18.7
Cincinnati, Ohio	5.9	5.8	5.5	5.5	5.6	5.4	5.9	6.8	8.7	9.7	10.7	11.0	10.9	11.9	11.9	11.5	10.9	10.4	9.1	7.6	7.2	7.3	6.7	6.5	8.3
Cleveland, Ohio	12.1	12.3	13.1	14.0	13.9	13.8	13.7	14.0	13.9	14.9	15.7	16.2	16.9	16.6	16.1	15.5	14.7	14.2	13.8	14.5	13.0	13.0	13.4	13.0	14.3
Columbia, Mo	8.5	8.4	8.6	8.9	9.4	9.2	8.7	8.9	9.4	10.3	11.6	12.6	13.4	13.5	13.3	12.6	12.3	11.2	10.6	8.5	7.4	7.6	7.3	7.7	10.0
Columbus, Ohio	7.1	6.0	6.4	6.6	6.5	6.3	6.5	7.6	8.7	9.5	10.4	10.8	11.4	11.5	11.9	12.1	11.8	10.2	9.1	7.6	7.4	7.7	7.6	7.3	8.7
Concordia, Kans	7.3	7.2	7.4	7.0	6.7	6.9	6.9	7.3	8.8	10.1	10.5	10.9	12.0	12.1	11.9	11.7	11.4	11.3	10.9	8.7	6.8	6.2	6.9	7.6	8.9
Corpus Christi, Tex	12.0	11.4	10.4	10.3	9.5	9.3	9.6	10.0	11.0	11.6	11.7	11.9	13.1	14.3	15.5	16.4	16.9	16.7	16.4	15.4	14.3	13.6	13.4	12.4	12.8
Davenport, Iowa	5.5	5.4	5.8	5.8	5.8	5.4	5.7	6.4	8.3	9.6	10.4	10.8	11.2	11.5	11.5	11.0	10.3	10.2	8.7	6.8	6.1	5.9	5.6	5.8	7.9
Denver, Colo	7.4	7.3	7.6	7.1	6.8	6.6	6.7	6.7	6.2	6.1	6.6	7.5	7.8	8.9	10.4	11.4	10.6	10.6	11.4	12.1	9.8	9.7	8.8	8.6	8.5
Des Moines, Iowa	7.2	6.9	6.5	6.5	6.6	6.7	7.1	8.1	9.0	10.0	12.0	12.7	13.4	13.5	13.4	12.8	12.8	11.5	10.8	8.7	7.5	6.8	7.2	7.6	9.4
Detroit, Mich	8.8	8.2	8.2	8.9	9.0	9.0	9.0	9.1	9.5	9.8	9.8	11.0	11.5	11.6	11.9	12.4	12.4	12.0	9.9	8.7	8.6	8.5	9.0	9.1	9.8
Dodge City, Kans	12.6	11.9	11.0	11.0	10.9	11.0	11.4	10.6	12.1	15.8	17.9	18.3	18.5	18.5	18.4	18.6	18.8	17.8	16.5	14.8	11.9	11.0	11.9	12.0	14.3
Dubuque, Iowa	5.7	5.4	5.8	5.8	6.3	6.1	6.2	7.1	8.5	9.7	11.0	11.8	13.0	13.1	12.6	12.7	12.7	11.9	11.1	8.5	6.7	6.5	6.1	5.4	8.7
Duluth, Minn	7.4	7.5	7.9	7.8	7.7	7.5	7.9	8.3	8.0	9.7	10.5	10.9	11.1	10.5	11.1	11.1	10.4	9.9	9.4	7.8	7.0	6.8	7.3	7.9	8.8
Eastport, Me	11.3	10.7	10.7	11.3	11.7	12.4	12.3	13.4	14.0	13.8	14.5	14.6	13.8	13.9	13.8	14.6	14.0	13.3	12.1	12.1	11.6	11.5	10.8	10.4	12.6
El Paso, Tex	12.0	10.7	9.5	10.1	11.0	11.3	11.4	10.7	8.9	10.5	12.4	13.6	13.6	13.4	14.4	16.4	17.1	15.5	16.3	16.0	14.0	12.5	13.0	12.3	12.8
Erie, Pa	9.1	9.1	9.3	9.8	10.0	10.6	10.1	10.5	11.2	12.3	12.9	13.3	13.6	13.7	13.8	13.3	13.3	12.0	10.7	10.3	9.2	9.0	8.9	9.3	11.1
Eureka, Cal	7.2	7.0	6.6	6.5	5.8	6.0	5.6	5.6	5.6	5.1	4.9	5.9	8.7	10.5	12.3	13.0	14.1	14.5	14.8	13.6	12.2	11.3	9.9	7.7	8.9
Fort Canby, Wash	14.5	14.0	13.1	13.0	12.3	11.3	10.0	10.5	11.2	11.2	12.8	12.9	12.8	11.8	12.0	12.3	12.1	13.7	14.4	14.5	14.6	14.6	14.6	14.0	12.8
Fort Smith, Ark	5.7	5.7	5.6	6.1	5.7	5.2	5.4	5.8	6.6	6.6	6.6	8.0	8.5	9.8	10.3	10.3	9.5	9.1	8.1	7.7	6.4	6.1	6.2	6.2	7.1
Fresno, Cal	7.8	7.8	7.7	7.8	6.8	6.1	5.9	5.5	5.2	4.8	5.6	6.2	6.3	5.7	5.6	5.8	6.1	5.9	6.9	7.6	8.5	7.6	7.7	7.9	6.6
Galveston, Tex	10.1	10.5	10.7	10.3	10.2	10.3	11.1	10.9	11.6	12.0	12.5	12.1	12.7	12.3	11.6	11.9	12.4	11.7	11.6	12.0	12.3	12.1	11.4	10.8	11.5
Grand Haven, Mich	7.6	7.5	8.2	7.6	7.5	7.2	7.4	7.9	9.0	9.7	11.0	12.0	12.9	13.1	13.5	13.0	11.7	11.1	9.8	8.0	7.2	7.5	7.9	7.9	9.4
Greenbay, Wis	7.6	7.5	7.1	7.0	7.0	6.9	6.8	7.1	8.2	8.4	9.3	9.3	9.9	9.6	9.7	9.5	9.6	8.9	8.8	8.8	8.4	8.7	9.3	8.1	8.4
Hannibal, Mo	8.4	8.1	8.6	8.8	9.2	9.3	9.4	9.9	11.0	12.3	13.5	13.9	14.4	13.7	13.1	12.9	12.5	11.3	10.1	8.2	7.9	8.4	8.9	9.3	10.5
Harrisburg, Pa	6.4	6.4	6.4	6.6	6.6	7.0	7.6	8.5	10.3	11.4	11.4	11.7	12.9	12.9	12.7	12.2	12.1	11.4	9.6	8.3	8.3	7.6	6.6	6.5	9.2
Hatteras, N. C	16.7	17.1	17.0	17.2	17.7	17.5	17.0	17.6	16.7	17.3	15.8	15.4	15.0	15.6	15.8	16.2	15.4	15.0	14.8	15.0	14.7	14.6	15.4	15.7	16.1
Havre, Mont	10.7	10.4	9.6	10.4	9.5	10.2	9.6	8.7	9.2	10.8	11.7	12.3	13.3	13.7	13.5	14.2	14.1	14.7	14.6	14.1	12.4	11.4	10.8	10.2	11.7
Helena, Mont	8.0	7.5	8.1	8.3	7.6	7.0	7.3	7.3	6.8	6.0	6.6	7.2	8.3	10.0	11.3	11.3	11.4	11.1	11.0	10.9	9.2	9.1	8.7	8.8	8.7
Huron, S. Dak	12.6	12.2	12.1	12.0	12.4	12.0	11.1	12.0	12.8	14.5	15.7	16.1	17.0	18.5	18.7	18.8	19.0	19.5	19.0	17.0	13.5	13.1	12.6	13.4	14.8
Idaho Falls, Idaho	10.0	9.5	8.4	7.7	8.0	8.1	8.3	8.6	8.4	9.3	10.6	11.6	12.0	13.3	14.2	14.3	15.3	16.5	17.0	17.5	15.7	13.5	13.1	11.3	11.7
Indianapolis, Ind	8.8	8.5	8.3	8.5	9.1	8.7	9.0	9.4	10.9	11.7	13.1	13.2	13.8	14.2	14.2	13.9	13.7	12.5	11.1	10.1	9.4	8.9	9.0	8.7	10.8
Jacksonville, Fla	5.5	5.5	5.6	6.5	6.2	6.1	5.7	6.7	8.4	9.5	10.0	10.1	10.6	10.5	10.4	10.7	10.8	9.5	7.6	6.2	5.6	5.1	5.4	5.6	7.6
Jupiter, Fla	9.0	9.0	9.0	8.8	8.6	8.4	8.1	8.5	10.2	11.8	12.9	13.6	13.7	13.8	14.4	14.8	14.3	13.5	12.4	10.7	10.8	10.3	10.1	9.2	11.1
Kansas City, Mo	6.7	7.1	6.8	7.1	6.8	6.8	7.1	7.6	9.0	10.1	11.5	12.3	12.4	11.7	11.5	11.5	11.8	11.5	10.2	9.2	8.1	7.6	7.3	6.7	9.1
Keokuk, Iowa	6.8	7.1	7.2	7.2	7.1	6.8	7.1	7.9	9.0	10.1	10.4	10.8	11.6	11.9	12.1	11.5	10.8	9.8	8.6	6.9	6.3	6.3	6.8	6.3	8.6
Key West, Fla	10.4	10.3	10.8	10.3	10.7	10.6	10.7	11.4	12.6	13.0	13.0	12.8	12.6	12.0	11.9	11.8	11.5	11.4	11.1	11.3	11.3	11.2	11.7	11.2	11.5
Kittyhawk, N. C	14.7	14.6	15.9	16.9	17.2	17.6	17.7	18.7	18.2	18.2	17.7	17.1	16.2	17.1	17.7	17.8	17.2	16.3	15.8	15.9	15.3	15.7	15.8	15.4	16.7
Knoxville, Tenn	6.4	5.7	6.0	5.8	5.9	6.2	6.1	5.9	6.6	7.3	8.4	9.1	10.0	10.0	10.8	10.4	10.5	10.5	9.1	8.4	7.7	6.0	6.6	6.6	7.7
La Crosse, Wis	5.6	5.9	5.7	5.7	5.5	5.5	5.3	6.5	6.7	7.5	8.6	9.5	9.2	9.3	10.1	10.0	9.2	9.0	8.9	7.3	6.8	5.9	6.1	5.9	7.3
Lander, Wyo	4.2	4.4	4.2	3.9	3.8	3.9	3.3	3.5	3.4	3.5	4.5	5.2	5.8	6.2	6.6	7.7	8.2	9.2	9.2	8.8	7.5	6.5	4.8	4.8	5.6
Lexington, Ky	10.1	10.0	10.8	10.6	10.1	10.2	10.5	10.1	11.8	12.7	13.5	13.8	14.8	14.8	14.9	14.3	12.7	12.3	10.5	8.8	9.7	9.3	9.3	9.9	11.5
Little Rock, Ark	6.7	6.4	6.4	6.7	7.0	6.4	6.0	6.5	8.8	10.1	10.8	10.0	10.8	10.9	10.5	11.1	10.9	11.2	10.2	8.1	7.4	7.2	6.7	7.1	8.5
Los Angeles, Cal	2.8	3.0	2.9	2.7	2.7	2.9	2.4	2.5	2.6	2.6	3.3	3.8	4.7	5.4	6.0	7.5	9.1	9.6	9.5	8.4	7.1	5.4	3.5	3.1	4.7
Louisville, Ky	7.1	7.6	7.4	7.1	7.5	7.3	7.1	7.9	8.9	10.1	10.8	11.3	11.7	11.9	12.2	12.7	12.5	11.5	10.0	8.6	7.9	7.9	7.9	7.9	9.3
Lynchburg, Va	4.3	4.1	4.2	4.0	3.6	3.7	4.2	5.7	6.8	7.1	6.9	7.0	7.8	7.7	7.6	7.3	7.2	7.1	5.9	5.8	4.8	4.4	3.9	3.7	5.6
Marquette, Mich	8.2	8.3	8.6	8.9	9.2	8.9	8.7	9.5	11.2	11.9	12.6	12.9	13.1	13.4	13.7	13.3	12.7	11.6	9.5	7.7	6.8	6.9	8.0	8.8	10.2
Memphis, Tenn	11.4	11.0	9.8	9.3	10.1	9.7	10.4	10.5	11.3	11.5	11.8	11.8	11.9	11.0	11.5	11.0	11.7	11.3	10.7	9.3	8.9	9.5	10.0	10.5	10.7
Milwaukee, Wis	10.8	10.7	10.4	9.8	9.7	9.1	9.0	9.7	10.7	11.2	11.5	12.8	14.1	14.4	14.1	14.2	13.8	12.5	11.8	10.3	10.1	9.6	9.4	9.5	11.2
Mobile, Ala	6.7	5.6	6.0	5.5	5.6	5.1	4.9	5.4	6.6	7.4	7.5	8.4	10.1	10.6	11.0	11.2	10.8	10.5	9.0	7.6	7.0	6.6	6.8	6.7	7.6
Montgomery, Ala	5.3	4.8	4.5	4.8	5.1	5.1	5.1	6.0	6.9	8.2	9.5	9.2	9.6	10.0	9.9	10.5	10.3	9.3	7.8	6.2	5.9	6.0	5.5	5.5	7.1
Moorhead, Minn	10.9	10.7	10.8	10.7	10.6	9.7	9.3	9.4	10.2	11.3	11.6	12.0	12.9	13.1	14.0	14.1	13.9	13.3	13.0	11.3	10.6	10.7	11.4	11.8	11.6
Nantucket, Mass	13.6	13.6	13.5	14.1	14.1	14.8	15.2	16.5	16.7	16.6	16.5	17.0	17.3	16.7	16.6	16.0	16.1	14.9	14.3	14.1	14.0	14.1	13.9	13.8	15.2
Nashville, Tenn	5.7	5.2	5.3	5.5	6.0	6.0	5.8	6.2	7.3	8.6	9.3	9.7	10.4	11.0	11.4	10.9	11.4	10.3	9.3	8.6	7.8	6.7	5.7	5.8	7.9
New Haven, Conn	10.5	10.5	10.3	9.6	9.6	9.4	10.2	11.6	13.5	14.4	14.9	15.0	16.1	15.9	15.4	14.7	14.2	12.0	11.3	9.9	10.1	9.7	10.6	10.2	12.1
New Orleans, La	8.0	8.3	7.9	7.4	7.6	7.1	6.8	7.8	8.9	10.4	11.3	11.4	12.6	12.9	13.4	13.4	13.3	12.6	11.3	10.0	9.9	10.1	9.5	8.2	10.0
New York, N. Y	11.3	11.9	11.9	12.2	13.2	12.8	14.1	14.4	14.8	14.5	14.9	15.6	16.3	16.2	16.5	16.5	15.9	15.4	15.7	14.9	13.4	12.4	12.6	12.2	14.2
Norfolk, Va	9.4	9.6	9.4	9.1	9.1	9.1	9.1	9.8	10.7	11.2	11.6	12.1	13.6	13.3	13.5	12.9	12.3	10.9	9.7	8.5	9.3	10.4	9.5	9.1	10.5
Northfield, Vt	6.3	6.0	5.3	5.4	5.4	5.3	6.5	7.5	9.1	11.2	13.1	13.7	14.1	14.5	14.4	14.4	13.6	12.9	9.5	7.3	7.5	7.4	7.6	7.0	9.4
North Platte, Nebr	9.0	8.4	9.0	9.3	9.6	8.9	9.1	9.2	10.6	12.6	15.6	16.6	17.4	17.5	17.7	18.0	17.3	17.7	17.1	14.6	12.3	10.8	10.7	10.2	12.9
Oklahoma, Okla	10.6	10.4	10.1	9.5	9.8	10.0	10.0	10.4	12.8	15.1	16.6	16.6	16.1	16.8	17.6	17.3	16.6	16.8	16.2	14.2	12.4	12.1	11.9	12.2	13.4
Omaha, Nebr	7.3	7.3	7.7	7.6	7.3	6.9	6.4	7.1	8.2	9.1	10.1	10.8	11.5	12.0	12.2	12.0	12.3	11.8	10.3	9.2	7.8	7.6	7.4	7.7	9.1
Oswego, N. Y	9.4	9.5	9.5	9.4	9.7	9.3	9.6	10.5	11.2	11.1	12.1	11.9	13.1	12.8	13.4	13.2	12.6	11.4	10.4	10.1	10.4	10.5	9.7	9.5	10.8
Palestine, Tex	6.6	6.6	6.1	6.0	6.5	6.0	5.9	6.3	6.7	8.2	9.3	9.8	10.3	10.3	10.4	10.2	10.4	9.5	9.3	7.5	6.1	6.9	7.1	7.1	7.9
Parkersburg, W. Va	5.0	5.4	5.1	4.4	4.6	4.3	4.8	4.9	6.2	7.3	8.4	9.1	9.9	10.7	11.7	10.9	10.4	9.6	8.4	6.7	5.9	4.8	4.9	4.8	7.0

TABLE VI.—*Average wind movement, etc.*—Continued.

Stations.	1 a. m.	2 a. m.	3 a. m.	4 a. m.	5 a. m.	6 a. m.	7 a. m.	8 a. m.	9 a. m.	10 a. m.	11 a. m.	Noon.	1 p. m.	2 p. m.	3 p. m.	4 p. m.	5 p. m.	6 p. m.	7 p. m.	8 p. m.	9 p. m.	10 p. m.	11 p. m.	Midnight.	Mean.
Pensacola, Fla	9.2	8.8	8.4	8.3	8.3	8.8	8.8	9.4	9.9	10.4	10.9	11.4	12.0	13.1	13.4	13.5	13.5	12.5	12.2	10.1	9.0	8.7	9.0	9.4	10.4
Philadelphia, Pa	9.5	9.8	9.9	10.7	10.5	11.2	11.7	12.3	13.2	14.0	14.3	14.6	15.8	15.3	15.4	15.2	14.3	12.8	11.8	11.5	11.3	10.8	9.7	9.2	12.3
Phœnix, Ariz	4.0	3.7	4.1	4.2	4.3	4.0	4.1	3.6	3.6	4.3	5.1	5.7	5.7	5.5	6.0	6.4	7.1	6.9	6.7	6.2	4.9	3.8	4.1	4.6	4.9
Pierre, S. Dak	9.7	8.3	8.3	8.8	8.1	8.6	8.5	8.5	9.1	11.5	13.8	15.2	16.9	16.1	16.8	16.0	16.4	15.6	15.3	13.9	12.0	11.9	11.6	10.6	12.1
Pittsburg, Pa	5.7	5.9	5.6	5.5	5.9	5.5	6.1	7.1	7.6	7.9	8.6	9.4	9.0	9.5	9.6	9.5	9.3	8.7	7.9	6.8	6.4	5.9	5.9	5.5	7.3
Port Angeles, Wash	5.4	6.6	6.3	6.4	6.7	6.4	6.6	6.9	6.3	5.3	4.2	4.7	6.1	6.6	6.5	6.4	7.3	7.2	7.3	8.1	7.9	6.4	5.6	5.7	6.4
Port Huron, Mich	10.0	10.6	10.8	10.8	11.3	11.1	11.1	11.7	12.5	12.9	13.7	14.4	14.4	14.3	14.1	13.6	13.6	12.2	11.1	10.3	9.3	8.8	8.5	8.8	11.7
Portland, Me	6.4	6.4	6.4	6.8	6.6	7.3	7.7	8.1	9.2	9.9	10.2	10.9	11.3	11.5	11.7	11.6	10.4	9.5	8.7	7.7	7.8	7.6	7.4	6.3	8.6
Portland, Oreg	9.1	8.5	8.2	8.0	7.4	7.1	8.0	7.2	7.4	6.9	7.7	7.6	8.7	9.4	9.5	8.7	8.7	9.5	10.0	10.5	10.1	9.7	10.1	9.9	8.7
Pueblo, Colo	8.0	6.8	6.3	6.4	5.8	5.9	6.2	6.0	5.7	6.9	8.0	9.6	10.1	12.0	13.1	13.6	13.6	12.3	13.2	13.2	12.9	12.3	9.5	8.6	9.4
Raleigh, N. C	5.9	5.9	5.7	5.8	5.7	5.6	5.8	6.9	8.5	9.0	9.0	9.7	10.2	10.4	11.1	10.3	9.7	8.2	6.4	6.3	5.9	6.0	6.4	6.3	7.5
Rapid City, S. Dak	7.7	8.1	8.3	8.0	7.4	7.4	7.9	7.7	8.1	9.7	11.2	12.3	14.4	14.3	13.7	13.5	13.3	13.5	13.0	12.1	9.1	7.0	6.4	6.9	10.0
Redbluff, Cal	7.2	7.6	6.6	6.8	6.4	6.2	6.0	5.7	4.9	5.0	6.3	7.3	8.1	8.3	8.4	8.7	8.5	8.6	8.3	8.2	7.9	7.6	7.3	6.6	7.2
Richmond, Va	6.7	6.7	6.7	6.4	6.2	6.5	6.9	7.7	9.3	10.0	10.6	10.6	10.6	11.1	11.4	10.2	9.8	8.6	7.6	7.0	6.7	6.1	5.9	6.2	8.2
Rochester, N. Y	6.7	6.9	6.6	6.4	6.5	7.0	7.7	8.5	8.2	9.0	9.6	10.1	11.2	11.1	11.4	11.1	10.2	9.4	7.7	6.9	7.0	7.0	6.6	6.9	8.3
Roseburg, Oreg	2.7	2.3	2.3	2.1	2.0	2.1	2.2	1.7	1.7	1.5	2.3	3.1	4.1	5.0	5.9	6.7	6.8	7.1	7.9	8.0	7.4	5.2	4.0	3.0	4.1
Sacramento, Cal	9.9	9.3	8.6	8.8	9.0	9.3	9.3	9.2	8.5	7.7	7.7	8.5	8.5	8.5	9.0	9.5	9.9	10.8	11.3	10.9	10.4	10.6	9.7	10.0	9.4
St. Louis, Mo	9.1	9.6	9.5	9.8	10.7	10.6	10.6	10.8	11.2	11.8	12.9	12.5	13.0	13.6	13.9	13.3	12.7	11.7	10.9	9.9	8.5	8.8	8.9	9.2	11.0
St. Paul, Minn	5.2	5.2	5.8	6.4	6.4	6.0	6.5	7.2	7.8	8.7	9.5	10.3	10.8	10.7	10.8	9.7	9.0	8.3	7.5	6.7	5.7	6.0	6.5	6.2	7.6
Salt Lake City, Utah	5.3	5.9	5.9	5.4	4.7	5.0	4.7	5.0	4.7	4.9	5.4	6.9	7.7	9.0	10.2	10.9	10.8	10.7	9.2	9.5	7.4	6.4	6.1	5.5	7.0
San Antonio, Tex	8.2	8.2	7.4	6.9	6.7	6.5	6.4	6.5	7.5	10.0	11.4	10.9	11.4	11.2	11.9	11.9	11.8	13.1	13.5	13.4	11.2	10.9	10.8	9.6	9.9
San Diego, Cal	4.5	3.8	3.8	3.7	3.8	3.7	3.9	3.9	3.6	3.4	4.0	5.1	7.4	9.7	10.9	11.8	11.3	10.9	9.7	8.7	7.5	6.3	5.4	4.6	6.3
Sandusky, Ohio	8.2	8.5	8.6	8.3	8.3	8.0	8.6	8.8	9.3	10.2	10.6	10.3	10.5	10.6	10.7	10.0	10.2	10.2	9.2	8.7	8.5	8.9	8.5	8.4	9.2
San Francisco, Cal	10.9	11.1	10.3	8.6	8.1	7.9	7.7	7.6	6.9	6.6	7.5	8.2	9.1	10.6	13.1	16.3	19.2	19.8	20.9	20.1	19.4	17.5	15.3	11.9	12.3
San Luis Obispo, Cal	3.4	3.5	3.3	3.3	4.6	4.3	4.9	4.9	4.4	4.8	5.8	6.3	6.7	7.6	8.8	9.8	9.6	9.3	9.1	8.0	7.5	6.6	5.4	4.0	6.1
Santa Fe, N. Mex	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sault Ste Marie, Mich	5.3	5.7	6.1	5.7	5.7	5.7	6.4	7.2	7.9	9.1	11.3	12.5	13.4	14.5	14.9	16.3	15.3	14.0	12.5	10.2	8.5	7.8	7.5	6.0	9.6
Savannah, Ga	8.1	7.8	7.6	7.4	7.0	6.8	6.9	7.5	8.6	10.0	10.1	10.7	12.3	12.5	12.5	13.2	13.7	11.7	10.5	9.2	9.3	8.7	9.1	8.5	9.6
Seattle, Wash	3.7	4.1	4.3	4.4	4.6	4.1	4.4	4.4	3.7	3.9	4.7	5.0	5.5	6.0	6.4	7.2	7.3	7.0	6.9	6.5	6.1	5.4	5.4	4.8	5.2
Shreveport, La	7.3	7.2	7.1	6.5	6.4	6.8	7.0	7.0	8.0	9.0	9.3	9.9	10.0	10.5	11.1	11.0	10.2	9.9	9.4	7.4	6.5	6.2	7.3	7.3	8.3
Sioux City, Iowa	12.5	12.3	12.9	13.2	12.2	12.0	12.0	12.4	12.7	14.4	16.2	16.7	17.4	17.2	17.7	18.1	18.3	17.7	17.7	15.3	14.2	13.9	13.4	12.6	14.7
Spokane, Wash	5.7	4.8	4.8	5.2	5.6	6.0	6.5	6.7	6.4	6.3	7.8	8.1	8.1	8.3	9.1	9.2	9.0	8.5	8.2	8.1	7.3	6.2	5.9	6.4	7.0
Springfield, Ill	8.6	8.6	8.8	9.0	9.6	9.7	10.0	10.2	10.7	12.0	12.7	13.2	13.5	13.5	13.3	13.3	13.2	12.4	11.5	8.5	7.4	8.1	8.5	9.0	10.6
Springfield, Mo	11.6	11.1	10.9	10.5	10.4	11.1	11.2	11.4	13.0	13.8	13.7	13.6	13.1	13.0	13.4	13.6	13.7	13.4	12.3	11.1	10.1	10.5	11.6	12.3	12.1
Tacoma, Wash	5.4	4.8	4.5	4.2	4.0	3.9	3.6	3.9	4.3	4.5	5.4	5.7	6.3	7.1	7.2	8.0	8.1	7.2	7.7	7.2	7.2	6.9	5.9	6.4	5.8
Tampa, Fla	6.4	6.1	5.7	6.0	5.6	5.1	6.2	7.0	9.4	10.0	10.0	9.6	11.2	11.4	11.8	11.7	12.0	11.0	9.8	7.6	6.5	5.5	5.3	5.4	8.2
Tatoosh Island, Wash	10.6	11.7	11.7	12.0	12.8	12.2	11.5	12.1	12.0	11.9	11.4	12.0	11.8	12.0	12.0	12.5	12.6	11.9	11.3	11.6	12.0	11.1	10.4	10.9	11.7
Toledo, Ohio	8.0	8.3	8.2	8.2	8.0	7.9	8.7	9.1	9.6	10.5	12.1	12.4	12.8	13.3	13.2	13.3	13.1	12.8	11.2	9.1	8.5	8.3	8.4	8.4	10.1
Vicksburg, Miss	6.6	6.8	6.8	6.5	6.9	8.1	8.3	7.9	7.8	8.4	9.0	8.1	8.8	9.2	9.5	9.0	8.5	8.3	7.5	6.0	6.8	6.5	7.2	7.4	7.7
Vineyard Haven, Mass	10.2	10.1	10.1	11.2	11.0	11.3	12.3	12.7	13.3	14.1	14.6	14.6	11.6	14.0	13.6	14.0	13.4	12.1	11.3	10.7	10.7	11.1	10.9	10.1	12.2
Walla Walla, Wash	6.3	5.9	5.9	6.0	5.8	5.4	5.6	5.4	5.2	5.3	6.0	6.1	5.7	6.1	6.6	7.1	7.0	7.6	7.7	7.5	7.1	5.8	6.1	6.4	6.2
Washington, D. C	6.2	6.6	6.4	6.6	6.8	6.2	6.4	8.3	10.0	11.6	11.6	11.7	12.6	13.7	13.5	13.0	12.3	10.2	7.8	6.6	7.0	6.5	6.1	5.7	8.9
Wichita, Kans	7.2	7.1	7.6	7.7	7.9	8.1	8.7	8.4	9.4	11.0	12.6	13.3	13.6	13.3	13.7	14.0	13.5	12.8	12.6	11.0	9.1	8.3	8.1	7.9	10.3
Williston, N. Dak	8.3	8.4	8.3	7.5	7.8	8.0	7.8	7.6	7.9	9.7	11.7	13.9	14.5	14.5	15.0	15.4	15.0	14.3	13.4	12.9	11.1	9.1	9.0	8.7	10.8
Wilmington, N. C	7.6	7.8	8.1	8.5	7.5	7.2	7.4	8.9	9.6	10.3	10.7	12.0	13.4	14.0	13.9	13.6	13.2	11.7	9.8	8.6	8.7	7.9	7.4	7.4	9.8
Woods Hole, Mass	13.6	13.9	13.9	14.9	14.9	15.6	16.4	17.2	17.6	18.4	18.6	18.3	18.2	18.7	19.0	17.8	17.2	16.2	14.7	13.8	13.5	13.3	13.5	13.4	15.9
Yankton, S. Dak	10.0	9.4	8.9	8.6	9.4	9.3	8.3	8.3	8.9	10.4	12.8	14.1	15.4	16.0	15.4	14.6	14.7	14.6	14.3	12.9	12.0	10.8	10.8	10.1	11.7

TABLE VII.—*Resultant winds from observations at 8 a. m. and 8 p. m., daily, during the month of April, 1898.*

Stations.	Component direction from—				Resultant.	
	N.	S.	E.	W.	Direction from—	Duration.
New England.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Eastport, Me	22	8	17	25	n. 30 w.	16
Portland, Me	29	10	14	23	n. 25 w.	21
Northfield, Vt	35	18	5	11	n. 19 w.	18
Boston, Mass	31	7	16	23	n. 16 w.	25
Nantucket, Mass	28	12	19	19	n.	16
Woods Hole, Mass.*	11	8	8	9	n. 18 w.	3
Block Island, R. I	29	9	18	23	n. 14 w.	21
New Haven, Conn	27	10	20	18	n. 7 e.	17
Middle Atlantic States.						
Albany, N. Y	25	14	9	20	n. 45 w.	16
Binghamton, N. Y.†	14	2	11	10	n. 5 e.	12
New York, N. Y	29	7	16	23	n. 18 w.	23
Harrisburg, Pa	25	10	14	24	n. 34 w.	18
Philadelphia, Pa	28	8	17	20	n. 9 w.	20
Atlantic City, N. J	24	9	17	27	n. 34 w.	18
Cape May, N. J	23	11	15	25	n. 40 w.	16
Baltimore, Md	22	12	15	25	n. 45 w.	14
Washington, D. C	31	11	10	23	n. 33 w.	24
Lynchburg, Va	26	13	7	31	n. 62 w.	27
Norfolk, Va	27	17	11	23	n. 50 w.	16
Richmond, Va	23	16	9	23	n. 63 w.	16
South Atlantic States.						
Charlotte, N. C	20	21	17	12	s. 79 e.	5
Hatteras, N. C	27	17	7	22	n. 56 w.	18
Raleigh, N. C	28	12	4	31	n. 59 w.	31
Wilmington, N. C	17	23	3	28	s. 77 w.	26
Charleston, S. C	21	23	5	23	s. 84 w.	18
Augusta, Ga	20	13	8	33	n. 74 w.	26
Savannah, Ga	22	23	5	20	s. 86 w.	15
Jacksonville, Fla	12	18	18	15	s. 27 e.	7
Florida Peninsula.						
Jupiter, Fla	14	21	17	17	s.	4
Key West, Fla	18	12	22	9	n. 65 e.	14
Tampa, Fla	21	11	9	32	n. 67 w.	25
Eastern Gulf States.						
Atlanta, Ga	23	15	9	35	n. 73 w.	27
Pensacola, Fla	24	19	10	22	n. 67 w.	13
Mobile, Ala	30	18	4	18	n. 49 w.	18
Montgomery, Ala	25	16	8	22	n. 57 w.	17
Vicksburg, Miss	20	20	16	14	e.	2
New Orleans, La	22	18	18	17	n. 14 e.	4
Western Gulf States.						
Shreveport, La	17	21	28	12	s. 76 e.	16
Fort Smith, Ark	20	8	29	11	n. 56 e.	22
Little Rock, Ark	17	16	16	23	n. 82 w.	7
Corpus Christi, Tex	12	23	32	6	s. 67 e.	28
Galveston, Tex	13	31	18	11	s. 21 e.	19
Palestine, Tex	24	21	22	11	n. 80 e.	11
San Antonio, Tex	17	22	32	4	s. 80 e.	28
Ohio Valley and Tennessee.						
Chattanooga, Tenn	21	16	7	28	n. 77 w.	22
Knoxville, Tenn	20	22	14	22	s. 76 w.	8
Memphis, Tenn	24	15	17	19	n. 13 w.	9
Nashville, Tenn	23	20	9	22	n. 77 w.	13
Lexington, Ky	18	16	19	24	n. 68 w.	5
Louisville, Ky	18	16	16	20	n. 63 w.	4
Evansville, Ind.†	10	8	8	10	n. 45 w.	3
Indianapolis, Ind	27	14	14	18	n. 17 w.	14
Cincinnati, Ohio	21	13	17	21	n. 27 w.	9
Columbus, Ohio	27	10	13	23	n. 30 w.	20
Pittsburg, Pa	31	7	14	19	n. 12 w.	24
Parkersburg, W. Va	22	18	14	22	n. 63 w.	9
Lower Lake Region.						
Buffalo, N. Y	16	13	20	24	n. 53 w.	5
Oswego, N. Y	17	14	15	26	n. 75 w.	11
Rochester, N. Y	27	12	17	27	n. 34 w.	18
Erie, Pa	17	12	17	24	n. 54 w.	9
Cleveland, Ohio	25	11	16	22	n. 22 w.	15
Sandusky, Ohio	23	11	22	16	n. 27 e.	13
Toledo, Ohio	27	6	19	21	n. 5 w.	21
Detroit, Mich	26	12	15	18	n. 12 w.	14
Upper Lake Region.						
Alpena, Mich	30	15	17	17	n.	15
Grand Haven, Mich	30	9	22	14	n. 21 e.	22
Marquette, Mich	32	10	10	26	n. 36 w.	27
Port Huron, Mich	37	10	9	11	n. 4 w.	27
Sault Ste. Marie, Mich	21	11	17	26	n. 42 w.	14
Chicago, Ill	32	11	10	11	n. 3 w.	21
Upper Lake Region—Cont'd.						
Milwaukee, Wis	28	14	22	7	n. 49 e.	20
Greenbay, Wis	29	17	18	8	n. 42 e.	15
Duluth, Minn	38	5	25	8	n. 28 e.	7
North Dakota.						
Moorhead, Minn	28	14	24	14	n. 36 e.	17
Bismarck, N. Dak	26	13	21	16	n. 21 e.	14
Williston, N. Dak	27	19	15	10	n. 32 e.	9
Upper Mississippi Valley.						
St. Paul, Minn	26	17	26	15	n. 51 e.	14
La Crosse, Wis. †	14	10	6	5	n. 14 e.	4
Davenport, Iowa	21	15	17	20	n. 27 w.	7
Des Moines, Iowa	28	17	16	13	n. 15 e.	11
Dubuque, Iowa	24	16	16	20	n. 27 w.	9
Keokuk, Iowa	20	20	11	20	w.	9
Cairo, Ill	21	19	14	18	n. 63 w.	4
Springfield, Ill	23	19	14	16	n. 27 w.	4
Hannibal, Mo. †	9	11	4	12	s. 69 w.	8
St. Louis, Mo	23	18	14	17	n. 31 w.	6
Missouri Valley.						
Columbia, Mo.*	13	5	10	7	n. 21 e.	8
Kansas City, Mo	25	16	19	16	n. 18 e.	10
Springfield, Mo	27	19	19	11	n. 45 e.	11
Lincoln, Nebr	26	21	18	9	n. 61 e.	10
Omaha, Nebr	28	19	11	15	n. 24 w.	10
Sioux City, Iowa†	15	8	6	7	n. 8 w.	7
Pierre, S. Dak	21	14	26	13	n. 62 e.	15
Huron, S. Dak	24	16	19	13	n. 37 e.	10
Yankton, S. Dak †	10	6	7	12	n. 51 w.	6
Northern Slope.						
Havre, Mont	15	7	19	29	n. 51 w.	13
Miles City, Mont	23	17	15	18	n. 27 w.	7
Helena, Mont	14	25	3	36	s. 72 w.	35
Rapid City, S. Dak	26	12	14	20	n. 23 w.	15
Cheyenne, Wyo	29	11	9	23	n. 38 w.	23
Lander, Wyo	14	25	10	30	s. 61 w.	23
North Platte, Nebr	23	21	12	16	n. 63 w.	4
Middle Slope.						
Denver, Colo	24	24	15	11	e.	4
Pueblo, Colo	20	11	27	12	n. 59 e.	18
Concordia, Kans	20	24	11	12	s. 14 w.	4
Dodge City, Kans	21	23	14	12	s. 45 e.	3
Wichita, Kans	27	22	13	6	n. 54 e.	9
Oklahoma, Okla	26	25	14	4	n. 84 e.	10
Southern Slope.						
Abilene, Tex	15	29	20	13	s. 27 e.	16
Amarillo, Tex	17	26	12	10	s. 13 e.	9
Southern Plateau.						
El Paso, Tex	19	9	22	22	n.	10
Santa Fe, N. Mex	17	24	19	17	s. 16 e.	7
Phœnix, Ariz	17	10	21	23	s. 16 w.	7
Yuma, Ariz	15	21	15	23	s. 53 w.	10
Middle Plateau.						
Carson City, Nev	15	18	6	34	s. 84 w.	28
Winnemucca, Nev	22	20	11	14	n. 56 w.	4
Salt Lake City, Utah	16	22	16	22	s. 45 w.	8
Northern Plateau.						
Baker City, Oreg	20	28	8	16	s. 45 w.	11
Idaho Falls, Idaho	18	31	7	13	s. 25 w.	14
Spokane, Wash	7	32	17	16	s. 2 e.	25
Walla Walla, Wash	10	33	10	16	s. 15 w.	24
North Pacific Coast Region.						
Fort Canby, Wash	28	14	13	13	n.	14
Port Angeles, Wash.*	5	0	12	16	n. 39 w.	6
Seattle, Wash	19	23	16	16	s.	4
Tacoma, Wash	21	20	7	21	n. 86 w.	14
Tatoosh Island, Wash	15	16	19	20	s. 45 w.	1
Portland, Oreg	22	20	9	26	n. 83 w.	17
Roseburg, Oreg	30	11	13	22	n. 24 w	22
Middle Pacific Coast Region.						
Eureka, Cal	23	19	8	28	n. 79 w.	20
Redbluff, Cal	24	19	16	17	n. 11 w.	5
Sacramento, Cal	16	32	13	13	s.	16
San Francisco, Cal	2	19	2	46	s. 69 w.	47
South Pacific Coast Region.						
Fresno, Cal	36	4	6	38	n. 45 w.	45
Los Angeles, Cal	9	16	12	36	s. 74 w.	25
San Diego, Cal	22	18	11	27	n. 76 w.	16
San Luis Obispo, Cal	25	8	5	28	n. 54 w.	29

* From observations at 8 p. m. only. † From observations at 8 a. m. only.

TABLE VIII.—*Thunderstorms and auroras, April, 1898.*

States.	No. of stations.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total. No.	Total. Days.	
Alabama	55	T.				10	2					1								5	8			3	5						1			35	8	T.
		A.																																0	0	A.
Arizona	56	T.		1									7	1	3	4	1	1	2		1	1				1	2	1		1	1	3		31	16	T.
		A.																																0	0	A.
Arkansas	59	T.			3	12			1		10	8	2							7	1		3	14	2	13	2	5	2	4		2		91	17	T.
		A.																																0	0	A.
California	180	T.	1													2						1		1					1		5	7		18	7	T.
		A.																																0	0	A.
Colorado	72	T.			1				2			2	1					4	4		3	3	5	2	1					1	17	6		52	14	T.
		A.																																0	0	A.
Connecticut	21	T.		1								10														11								22	3	T.
		A.												3																				3	1	A.
Delaware	5	T.		2												2										2	3							9	4	T.
		A.																																0	0	A.
Dist. of Columbia	4	T.											1																					1	1	T.
		A.																																0	0	A.
Florida	45	T.					5																		1	2								8	3	T.
		A.																																0	0	A.
Georgia	55	T.	1			4	2				1	1	1		1					2	11	1		1	13		1	3	1					44	15	T.
		A.																																0	0	A.
Idaho	38	T.																				2		2				2	1			1		8	5	T.
		A.											1																					1	1	A.
Illinois	86	T.			1	2				10	13	8			1				10	8			1	2			14	5		1	1	4		81	15	T.
		A.	1	1												1												1						4	4	A.
Indiana	57	T.								1	2	5							1															9	4	T.
		A.								1																								1	1	A.
Indian Territory	7	T.											1						1				2	2		1			1	1	1			10	8	T.
		A.																																0	0	A.
Iowa	130	T.								21								4	5				5	1			6					9		51	7	T.
		A.								1					1	2																		4	3	A.
Kansas	85	T.			5	4	1			3				4	1			2	11	4	1		18	8	4	1			1		14	17		99	17	T.
		A.																																0	0	A.
Kentucky	48	T.						1			5	12			1	1			1	2					1									24	8	T.
		A.																																0	0	A.
Louisiana	46	T.	2			8						2		1			1		5	10	12			11	1	1			1	2	1			58	14	T.
		A.																																0	0	A.
Maine	18	T.																1																1	1	T.
		A.												4					1															5	2	A.
Maryland	40	T.									2	11	5			5				1	4				1	3	5							37	9	T.
		A.									1		1														1							3	3	A.
Massachusetts	59	T.										1	1													12								14	3	T.
		A.		1										2	1																			4	3	A.
Michigan	104	T.										1						4	22													1		28	4	T.
		A.												1			1																	2	2	A.
Minnesota	67	T.								5											1		4			1		1				17		29	6	T.
		A.	1											3	4	5	1																	14	5	A.
Mississippi	43	T.			3	9						6							2	11	9			11	1	6			1		1			60	11	T.
		A.																																0	0	A.
Missouri	95	T.			4	9			2	2	5			1	2				12	5		1	11	10	6	12	9			1	4	22		118	18	T.
		A.																																0	0	A.
Montana	40	T.																		2							1	1						4	3	T.
		A.										1		1						1		1			1									5	5	A.
Nebraska	144	T.									1			1				1	7	1			5	1	7	1	1	1		1	10	20		58	14	T.
		A.														1																		1	1	A.
Nevada	50	T.																1				3	1									1		6	4	T.
		A.																																0	0	A.
New Hampshire	21	T.																																0	0	T.
		A.											1	3															1					5	3	A.
New Jersey	51	T.				2						24	1						7							24								58	5	T.
		A.				1								1																				2	2	A.
New Mexico	34	T.										2	4	1		1	1	2	3		1						1				1	1		18	11	T.
		A.																																0	0	A.
New York	113	T.								1		3							8	1						4								17	5	T.
		A.												7	1																	1		9	3	A.
North Carolina	57	T.								1		2				3					8				14	15	2	2	1					48	9	T.
		A.																																0	0	A.
North Dakota	52	T.																		1					1				1					3	3	T.
		A.				1		1				1	1	5	4	7	2																	22	8	A.
Ohio	134	T.									7	5				1			19	1							1			1				35	7	T.
		A.			1							1		1			1					1			1									6	6	A.
Oklahoma	21	T.																	1				1	2		1			1	2	3	2		13	8	T.
		A.																																0	0	A.
Oregon	72	T.											1	1							1	1	1											5	5	T.
		A.											1																					1	1	A.
Pennsylvania	105	T.									2	8	4		1				10		1					3								29	7	T.
		A.																										1						1	1	A.
Rhode Island	8	T.																								4								4	1	T.
		A.																																0	0	A.
South Carolina	40	T.				2	3					4			3	4				2	16			2	15	8		6	4					69	12	T.
		A.																																0	0	A.
South Dakota	56	T.												1						2				1	1							4		9	5	T.
		A.													1	2																		3	2	A.
Tennessee	59	T.				7					6	18			4	3			1	7	5			1	2	1		3						58	12	T.
		A.																																0	0	A.
Texas	89	T.								1		3	3	7	4		1	2	14	8	2		1	10		2				3	1			62	15	T
		A.																																0	0	A.
Utah	38	T.																5			2	2	2							4	4	3		22	7	T.
		A.																																0	0	A.
Vermont	14	T.																																0	0	T.
		A.							1					1															1					3	3	A.
Virginia	48	T.										3	2		1						2				1	2	2							13	7	T.
		A.																																0	0	A.
Washington	50	T.							1																									1	1	T.
		A.																																0	0	A.
West Virginia	33	T.									2	1	1								1													5	4	T.
		A.																																0	0	A.
Wisconsin	60	T.	1								3			1	1			6	2													9		23	6	T.
		A.													1	5	2																	8	3	A.
Wyoming	17	T.											1						1	1	1		2								1			7	6	T.
		A.																																0	0	A.
Sums	2,871	T.	5	4	17	69	18	1	6	45	59	141	36	19	23	26	4	33	149	82	90	15	62	85	77	131	50	30	16	22	66	129	....	1,505	....	T.
		A.	3	2	1	2	0	1	1	2	1	3	5	32	13	23	7	0	1	1	0	2	0	0	2	0	1	2	2	0	0	1	....	107	....	A.

TABLE IX.—*Average hourly sunshine (in percentages), April, 1898.*

Stations.	Instrument.	Percentages for each hour of local mean time ending with the respective hour.																Hours of sunshine.			
		A. M.								P. M.								Total.			Personal estimate.
		5	6	7	8	9	10	11	Noon	1	2	3	4	5	6	7	8	Actual.	Possible.	Percent of possible.	
																		Hours.	*Hours.*		
Albany, N. Y	T.	50	33	44	54	68	79	75	76	80	80	75	72	61	47	29	......	256.5	402.1	64	33
Atlanta, Ga	T.	......	63	56	59	64	61	67	70	74	76	72	69	57	49	48	......	250.3	391.6	64	49
Atlantic City, N. J	P.	......	43	53	47	44	56	60	51	61	54	56	54	33	36	34	......	195.8	397.0	49	37
Baltimore, Md	T.	......	36	48	70	77	79	81	80	79	76	72	69	64	35	26	......	260.3	397.0	66	43
Binghamton, N. Y	T.	71	37	43	46	52	55	54	62	49	55	56	55	45	32	27	......	194.0	401.1	48	35
Bismarck, N. Dak	P.	18	46	64	71	76	75	71	76	66	65	67	62	51	44	39	29	256.6	408.4	63	58
Boston, Mass	T.	71	40	41	49	50	52	49	47	50	49	42	36	33	38	26	......	173.9	401.1	43	35
Buffalo, N. Y	T.	64	38	46	67	75	87	84	86	89	85	83	70	59	49	37	......	279.7	402.1	70	37
Charleston, S. C	T.	......	70	66	58	63	77	74	79	71	75	75	67	59	52	52	......	263.1	390.5	67	63
Chattanooga, Tenn	T.	......	55	49	51	57	60	61	58	60	63	59	63	64	46	48	......	224.3	392.7	57	51
Cheyenne, Wyo	P.	0	49	57	71	73	74	74	71	68	65	76	68	57	50	33	......	257.1	399.4	64	52
Chicago, Ill	T.	0	32	39	50	66	68	69	68	67	67	62	52	41	33	29	......	217.1	401.1	54	54
Cincinnati, Ohio	T.	......	58	56	53	64	66	70	72	67	64	63	59	51	34	37	......	233.8	397.0	59	52
Cleveland, Ohio	T.	0	28	25	25	44	58	55	63	64	55	52	46	36	18	12	......	170.2	401.1	42	45
Columbia, Mo	T.	......	55	53	56	64	71	72	71	70	70	74	66	59	56	45	......	253.4	397.0	64	42
Columbus, Ohio	T.	......	51	52	63	73	78	77	85	91	87	81	73	67	50	37	......	279.8	398.6	70	46
Denver, Colo	P.	......	66	67	73	65	66	75	77	69	66	64	63	56	55	52	......	261.6	398.6	66	45
Des Moines, Iowa	T.	0	52	55	64	69	62	66	71	72	63	59	53	53	59	49	......	243.8	401.1	61	59
Detroit, Mich	T.	71	41	43	53	55	53	64	63	65	60	55	51	46	38	34	......	208.4	401.1	52	45
Dodge City, Kans	P.	....	42	48	61	74	77	74	73	78	78	78	74	63	56	39	......	265.0	396.2	67	60
Dubuque, Iowa	T.	29	39	44	60	64	72	75	76	78	76	72	68	60	47	38	......	253.3	401.1	63	61
Eastport, Me	P.	20	22	27	32	44	50	51	55	53	56	55	53	48	42	35	10	182.8	405.2	45	32
Erie, Pa	T.	71	37	37	46	63	68	73	74	76	77	70	61	48	41	42	......	236.0	401.1	59	39
Eureka, Cal	P.	0	25	30	32	43	50	56	59	55	58	47	47	47	41	37	......	181.6	399.4	45	40
Fresno, Cal	T.	......	76	69	70	73	87	95	96	98	97	98	96	83	81	84	......	341.4	394.8	86	82
Galveston, Tex	P.	......	52	53	66	74	68	69	75	75	72	78	74	74	64	47	......	265.9	386.4	69	62
Harrisburg, Pa	T.	......	49	59	66	83	90	99	97	92	92	87	80	64	38	28	......	297.6	398.6	75	34
Helena, Mont	P.	27	46	60	67	67	76	70	68	66	59	65	70	64	64	61	43	264.7	408.4	65	59
Huron, S. Dak	T.	59	49	53	50	61	68	67	65	63	65	60	53	38	37	40	0	223.2	403.6	55	46
Idaho Falls, Idaho	T.	14	42	44	66	78	85	86	86	86	85	78	76	71	54	30	......	283.5	402.1	71	68
Indianapolis, Ind	T.	......	40	43	44	53	60	61	61	64	54	50	44	27	27	25	......	189.0	398.6	47	43
Jacksonville, Fla	T.	......	61	57	63	76	88	89	89	89	88	84	77	67	57	58	......	293.1	387.4	76	63
Kansas City, Mo	P.	......	51	52	60	57	64	63	55	47	57	56	63	53	47	47	......	221.1	397.0	56	48
Key West, Fla	T.	......	28	40	42	75	82	93	93	91	96	91	83	77	69	65	......	290.3	382.5	76	68
Knoxville, Tenn	T.	......	46	42	48	58	65	74	69	77	75	72	66	59	45	43	......	240.1	393.6	61	58
Little Rock, Ark	T.	......	62	63	62	54	57	64	63	71	66	64	55	50	40	43	......	229.7	392.7	58	45
Los Angeles, Cal	P.	......	48	52	60	61	70	78	76	75	84	86	89	86	87	81	......	291.7	391.6	74	64
Louisville, Ky	T.	......	46	48	53	51	58	59	63	65	63	60	59	42	41	39	......	213.8	396.2	54	40
Minneapolis, Minn	T.	8	24	34	49	58	64	66	73	67	65	60	61	53	36	28	0	217.3	405.2	54	......
Nashville, Tenn	T.	......	57	60	62	67	67	72	77	81	81	75	75	65	65	56	......	273.0	393.6	69	58
New Orleans, La	T.	......	58	58	60	64	65	71	69	77	77	76	64	64	61	63	......	258.2	387.4	66	65
New York, N. Y	T.	0	7	26	41	47	49	62	65	59	58	48	48	42	35	29	......	181.3	399.4	45	34
Northfield, Vt	P.	33	42	50	63	63	63	58	55	52	54	51	49	45	37	21	0	206.1	403.6	51	37
Oklahoma, Okla	T.	......	55	55	64	66	74	77	73	73	71	76	72	66	44	38	......	258.6	392.7	66	62
Omaha, Nebr	P.	0	49	52	57	71	72	70	71	64	69	59	54	58	60	52	......	247.3	399.4	62	52
Parkersburg, W. Va	T.	......	41	43	45	48	59	58	66	64	64	58	42	30	29	34	......	196.1	397.0	49	45
Philadelphia, Pa	T.	......	30	41	45	58	60	57	64	67	57	45	39	36	29	25	......	189.6	398.6	48	32
Phœnix, Ariz	P.	......	62	77	92	98	94	94	91	91	91	85	80	82	73	74	......	334.7	390.5	86	77
Pittsburg, Pa	T.	0	45	47	47	50	51	55	63	61	66	62	51	45	50	47	......	212.4	399.4	53	34
Portland, Me	T.	13	14	34	46	52	69	73	72	75	71	69	60	45	29	17	0	215.1	403.6	53	36
Portland, Oreg	T.	17	19	23	41	58	68	76	74	73	71	66	62	52	44	42	50	228.6	407.0	56	48
Raleigh, N. C	T.	......	45	52	73	81	85	85	87	84	81	79	76	64	47	37	......	282.2	393.6	72	50
Rochester, N. Y	T.	64	38	40	43	51	62	61	64	70	63	58	55	44	38	34	......	209.6	402.1	52	48
St. Louis, Mo	T.	......	40	40	46	49	65	68	71	75	73	67	60	58	46	37	......	229.0	397.0	58	46
St. Paul, Minn	P.	40	35	41	55	59	63	66	66	61	60	61	60	57	47	39	0	225.6	405.2	56	50
Salt Lake City, Utah	P.	0	56	69	73	74	74	73	79	84	81	80	73	73	67	60	......	292.8	399.4	74	45
San Diego, Cal	P.	......	35	38	41	56	64	71	76	76	86	83	80	74	62	52	......	255.2	390.5	65	61
San Francisco, Cal	T.	......	23	35	54	83	90	100	100	100	100	98	92	80	75	40	......	313.3	396.2	79	59
Santa Fe, N. Mex	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Savannah, Ga	P.	......	70	72	78	77	81	84	79	74	73	76	72	66	58	59	......	286.2	389.9	73	60
Seattle, Wash	T.	0	0	0	17	27	40	54	61	66	64	55	48	36	12	2	0	144.3	410.4	35	41
Spokane, Wash	T.	86	47	51	70	82	91	95	96	89	88	88	69	67	52	41	80	304.7	410.3	74	43
Tacoma, Wash	T.	9	14	20	27	41	56	66	66	75	73	74	63	56	42	33	57	209.1	408.4	51	42
Tampa, Fla	T.	......	87	80	70	63	75	74	79	77	77	81	73	71	77	78	......	290.0	385.4	75	75
Vicksburg, Miss	T.	......	47	43	56	66	73	75	76	78	79	73	65	56	46	47	......	250.2	389.9	64	64
Washington, D. C	P.	......	47	52	59	61	67	67	59	56	56	54	60	48	39	36	......	219.0	397.0	55	45
Wilmington, N. C	T.	......	49	52	66	75	80	86	91	90	83	79	69	60	51	42	......	278.8	391.6	71	66
Yankton, S. Dak	T.	14	42	47	63	70	76	78	86	86	80	75	68	62	51	25	......	266.7	402.1	66	58

TABLE X.—*Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded* 0.25 *in any* 5 *minutes, or* 0.75 *in* 1 *hour during April,* 1898, *at all stations furnished with self-registering gauges.*

Stations.	Date.	Total duration.		Total am't of precipitation.	Excessive rate.		Amount before excessive began.	Depths of precipitation (in inches) during periods of time as indicated													
		From—	To—		Began—	Ended—		5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Albany, N. Y.	23-24			1.22														0.12			
Atlanta, Ga.	23	6.00 a.m.	9.58 a.m.	1.11	7.40 a.m.	8.25 a.m.	0.26	0.08	0.16	0.32	0.52	0.59	0.63	0.67	0.71	0.75					
Atlantic City, N. J	28			0.68														0.29			
Baltimore, Md	14			0.33														0.08			
Binghamton, N. Y.	23-24			1.80														0.20			
Bismarck, N. Dak.	30			0.39														0.07			
Boston, Mass.	15			1.03														0.36			
Buffalo, N. Y.	22-23			0.58														0.10			
Cairo, Ill.	25-26			0.78														0.25			
Charleston, S. C.	5			0.85														0.36			
Chicago, Ill *																					
Cincinnati, Ohio	13			0.31														0.10			
Cleveland, Ohio	22-24			1.12														0.19			
Columbia, Mo*																					
Columbus, Ohio	23-24			0.73														0.27			
Denver, Colo*																					
Des Moines, Iowa	17			0.81														0.66			
Detroit, Mich	17-18			0.21														0.16			
Dodge City, Kans.*																					
Duluth, Minn.*																					
Eastport, Me.	24-25			1.19														0.24			
Erie, Pa.	22-23			0.66														0.06			
Fresno, Cal.†																					
Galveston, Tex.	12-13	6.00 p.m.	6.38 a.m.	1.87	8.23 p.m.	9.23 p.m.	0.01	0.07	0.15	0.24	0.31	0.37	0.42	0.54	0.64	0.85	0.96	1.07			
Harrisburg, Pa.	14-15			0.45														0.09			
Hatteras, N. C.	14			0.72														0.45			
Huron, S. Dak.	29-30			2.19														0.30			
Idaho Falls, Idaho	20			0.07														0.07			
Indianapolis, Ind.	22-23			0.80														0.17			
Jacksonville, Fla.	5			0.34							0.34										
Jupiter, Fla.	4	8.40 a.m.	7.50 p.m.	1.67	3.40 p.m.	4.30 p.m.	0.55	0.20	0.37	0.50	0.62	0.64	0.66	0.69	0.80	0.93	1.00	1.04			
Kansas City, Mo.	3			0.91														0.31			
Key West, Fla.	4			0.52									0.45								
Knoxville, Tenn.	10			0.29														0.23			
Lincoln, Nebr.	3-4			1.44														0.19			
Little Rock, Ark.	22	8.40 a.m.	8.30 p.m.	1.45	2.10 p.m.	2.45 p.m.	0.48	0.05	0.16	0.29	0.50	0.59	0.70	0.75							
Los Angeles, Cal.	30			0.08																	
Louisville, Ky.	10			0.40														0.30			
Memphis, Tenn.	24			0.60												0.39					
Milwaukee, Wis.	18-19			1.15														0.20			
Montgomery, Ala.	4-5	7.09 p.m.	1.47 a.m.	2.40	7.57 p.m.	8.47 p.m.	0.15	0.07	0.14	0.21	0.27	0.33	0.38	0.45	0.80	1.02	1.10	1.15			
Do	23	2.00 a.m.	7.50 a.m.	1.06	4.35 a.m.	4.55 a.m.	0.21	0.25	0.50	0.66	0.72										
Nantucket, Mass.	28-29			0.70														0.19			
Nashville, Tenn.	4			1.00														0.43			
New Orleans, La.	4	8.15 p.m.	11.45 p.m.	0.79	10.30 p.m.	10.45 p.m.	0.10	0.35	0.50	0.63	0.65	0.67	0.69								
Do	19	7.00 a.m.	11.00 a.m.	1.28	7.20 a.m.	7.50 a.m.	0.22	0.12	0.30	0.42	0.52	0.57	0.61	0.62	0.64	0.66					
New York, N. Y.	24			0.62									0.36								
Norfolk, Va.	24			0.75														0.62			
Northfield, Vt.	24-25			1.15														0.15			
Oklahoma, Okla.	30			0.50														0.42			
Omaha, Nebr.	12			0.60														0.19			
Parkersburg, W. Va.	24-25			0.56														0.07			
Philadelphia, Pa.	24			0.68														0.34			
Pittsburg, Pa.	23-24			0.61														0.12			
Portland, Me.	24			1.64														0.23			
Portland, Oreg.	9			0.44														0.12			
Raleigh, N. C.	23-24			0.51														0.24			
Richmond	4-5			1.17														0.20			
Rochester, N. Y.	19			0.60														0.11			
St Louis, Mo.	25			0.77														0.29			
St. Paul, Minn.	30			0.49														0.18			
Salt Lake City, Utah	20-21			0.71														0.19			
San Diego, Cal.	7			0.09											0.09						
San Francisco, Cal.	5-6			0.19														0.07			
Savannah, Ga.	19-20			0.45														0.41			
Seattle, Wash.	6			0.21														0.09			
Spokane, Wash.	1-2			0.44														0.09			
Tampa, Fla.	5			0.10							0.10										
Vicksburg, Miss.	4			0.64												0.64					
Washington, D. C.	23-24			0.50														0.14			
Wilmington, N. C.	4-5			1.21														0.37			
Yankton, S. Dak. *																					

* Record incomplete. † No precipitation during the month.

TABLE XI.—*Excessive precipitation, by stations, for April*, 1898.

Stations.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
Alabama.	Inches.	Inches.		Ins.	h.m.	
Citronelle		2.85	45			
Eufaula				2.30	1 55	23
Fort Deposit		3.72	4-5			
Gadsden		2.66	4-5			
Highland Home		3.10	4-5			
Marion		3.10	4-5			
Montgomery		2.85	4-5	1.15	1 00	4
Newbern		2.77	4			
Newburg		2.80	18-19			
Tallassee		2.87	4-5			
Thomasville				2.11	1 00	20
Uniontown		2.72	4			
Do		2.57	23			
Wetumpka		3.79	4-5			
Arkansas.						
Moore		2.90	22			
Warren		2.68	22-23			
Connecticut.						
Colchester		2.50	23-24			
Lake Konomoc		3.53	22-23			
Voluntown		4.10	23-24			
Florida.						
Federal Point		6.57	23-24			
Jupiter				1.04	1 00	4
St. Francis Barracks		2.70	24			
Georgia.						
Adairsville		2.60	5			
Allentown		4.15	4-5			
Americus		3.25	4-5			
Athens		2.50	4-5			
Diamond		3.30	4-5			
Lawrenceville		2.73	4-5			
Louisville		3.00	5			
Marshallville		4.90	4	4.30	4 00	4
Do		3.50	23			
Reynolds		2.88	4-5			
Do		2.76	23			
Rome		3.45	4-5			
Talbotton		2.94	4-5			
Illinois.						
Olney		2.50	25-26			
Iowa.						
Indianola		2.60	18			
Kansas.						
Campbell		3.36	29-30	3.00	2 00	30
Garfield		3.35	17-18			
Linn		3.56	30	3.56	3 00	30
Pratt		2.75	29-30			
Wichita				1.00	1 00	17
Louisiana.						
Bastrop		3.22	22-23			
Calhoun		2.67	22			
Oakridge		2.68	22-23			

TABLE XI.—*Excessive precipitation*—Continued.

Stations.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
Massachusetts.	Inches.	Inches.		Ins.	h.m.	
Blue Hill		2.51	24			
Cohasset		3.16	23-24			
Dudley		2.70	23			
Mansfield		3.33	23-24			
Provincetown		2.81	23			
Taunton		3.62	24			
Minnesota.						
Bingham Lake		4.80	18			
Mississippi.						
Greenwood		2.82	18			
Windham				2.21	0 45	22
Missouri.						
Sublett		3.25	21-22			
Nebraska.						
Arapaho		2.50	3-4			
Norman		3.17	3			
North Dakota.						
University		3.48	29-30			
Oklahoma.						
Fort Sill		4.25	30			
Pennsylvania.						
Wellsboro		2.50	24			
Rhode Island.						
Lonsdale		3.08	23-24			
Providence		3.42	23-24			
South Carolina.						
Allendale		3.00	4-5			
Blackville				2.08	1 15	5
Edisto		3.10	4-5			
Florence		3.18	27-28			
Gillisonville		2.78	5			
Shaws Fork		2.75	4-5			
Smiths Mills		2.70	26-27			
Society Hill		2.80	26-27			
Yemassee		3.58	4-5			
Texas.						
Blanco		4.50	12			
Brazoria		2.50	12			
Burnet		4.85	11-12			
College Station		3.44	11-12			
Columbia		2.51	12-13			
Conroe		2.66	12			
Danevang		4.01	12-13			
Duval		3.35	12			
Galveston				1.07	1 00	12
Houston		4.40	13			
Runge		2.85	12-13			
Weatherford		2.70	17			
Virginia.						
Hampton		2.79	27-28			
Norfolk		2.63	27-28			

Chart I. Tracks of Centers of High Areas. April, 1898.

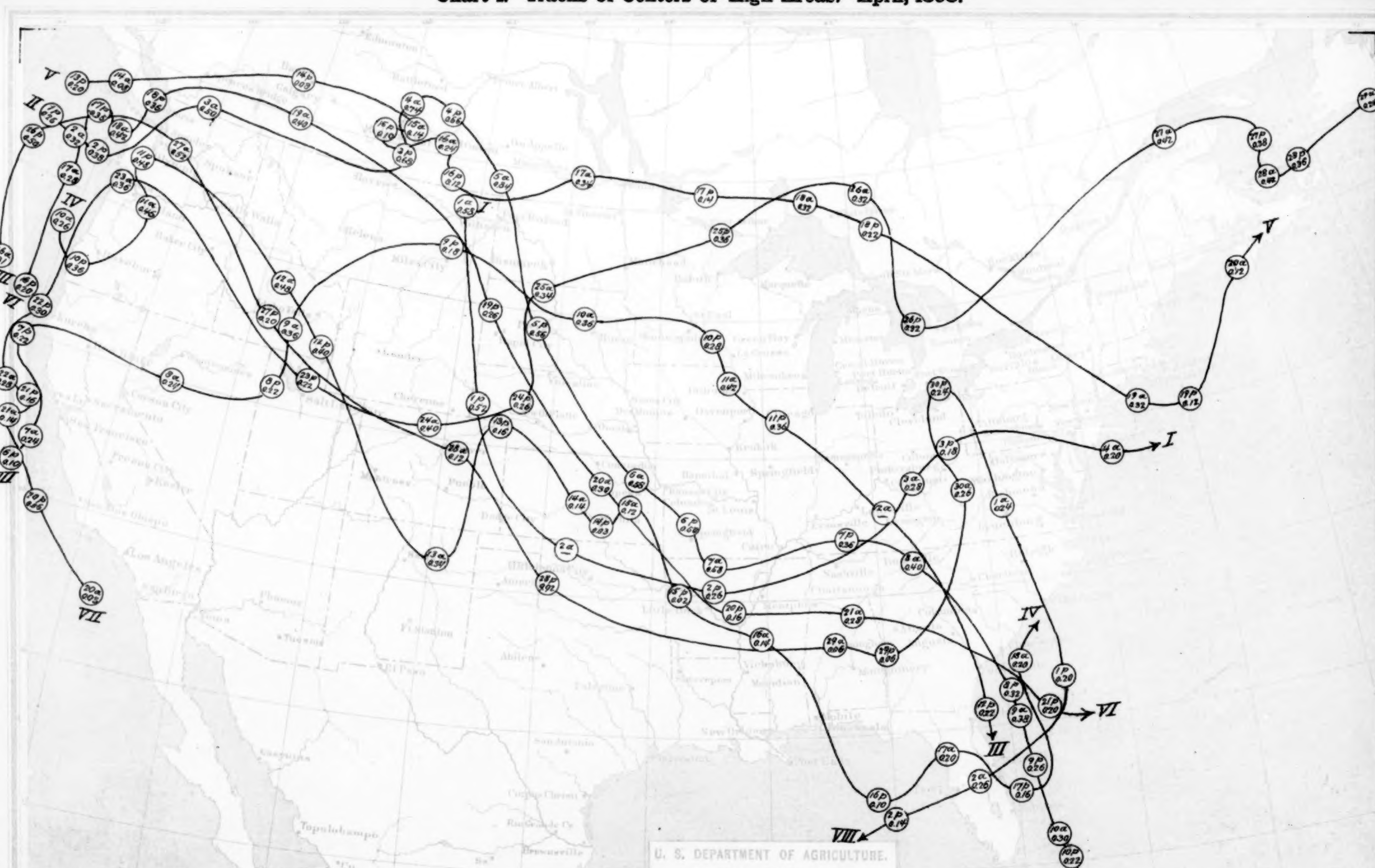


Chart II. Tracks of Centers of Low Areas. April, 1898.

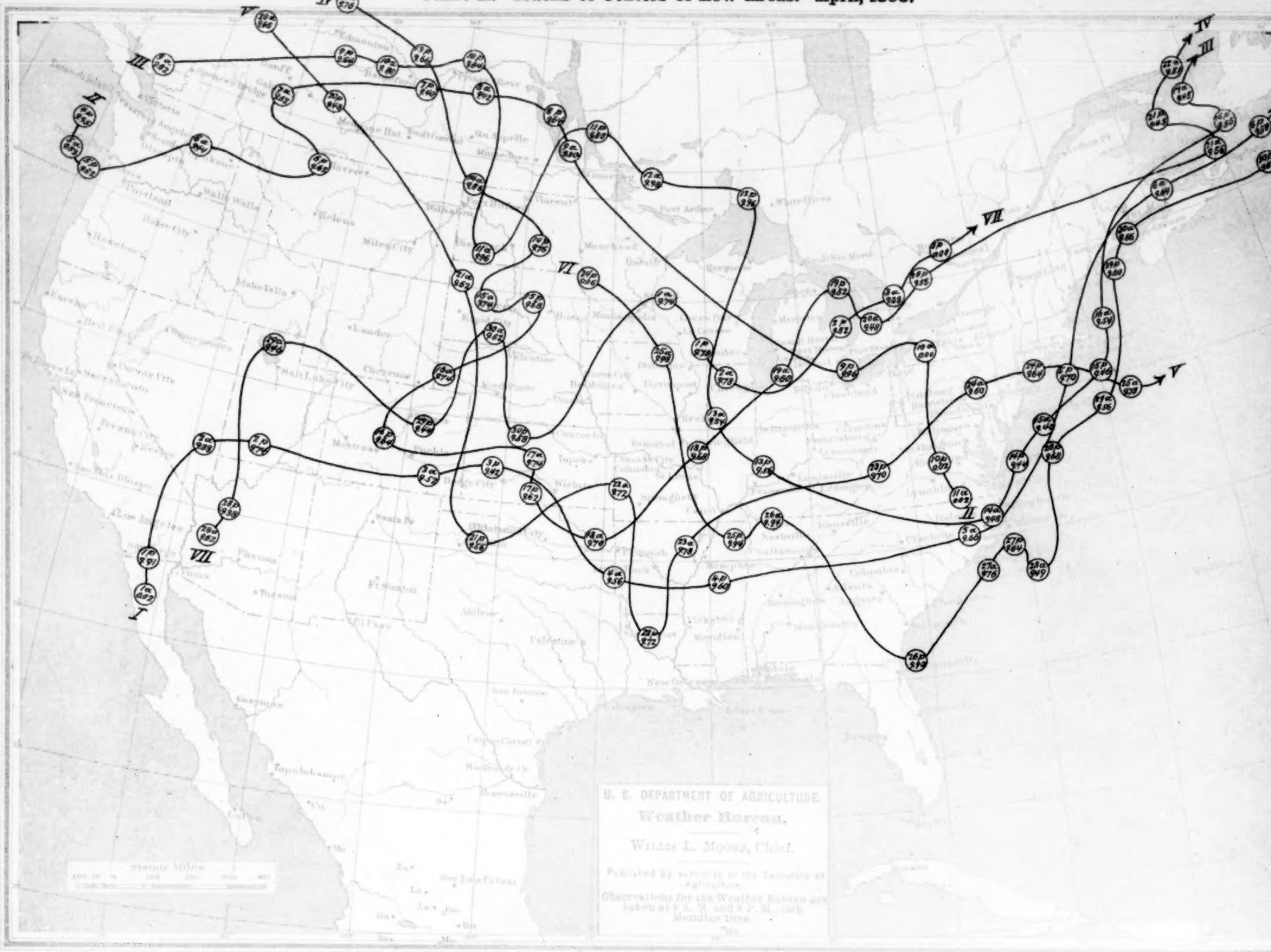


Chart III. Total Precipitation. April, 1898.

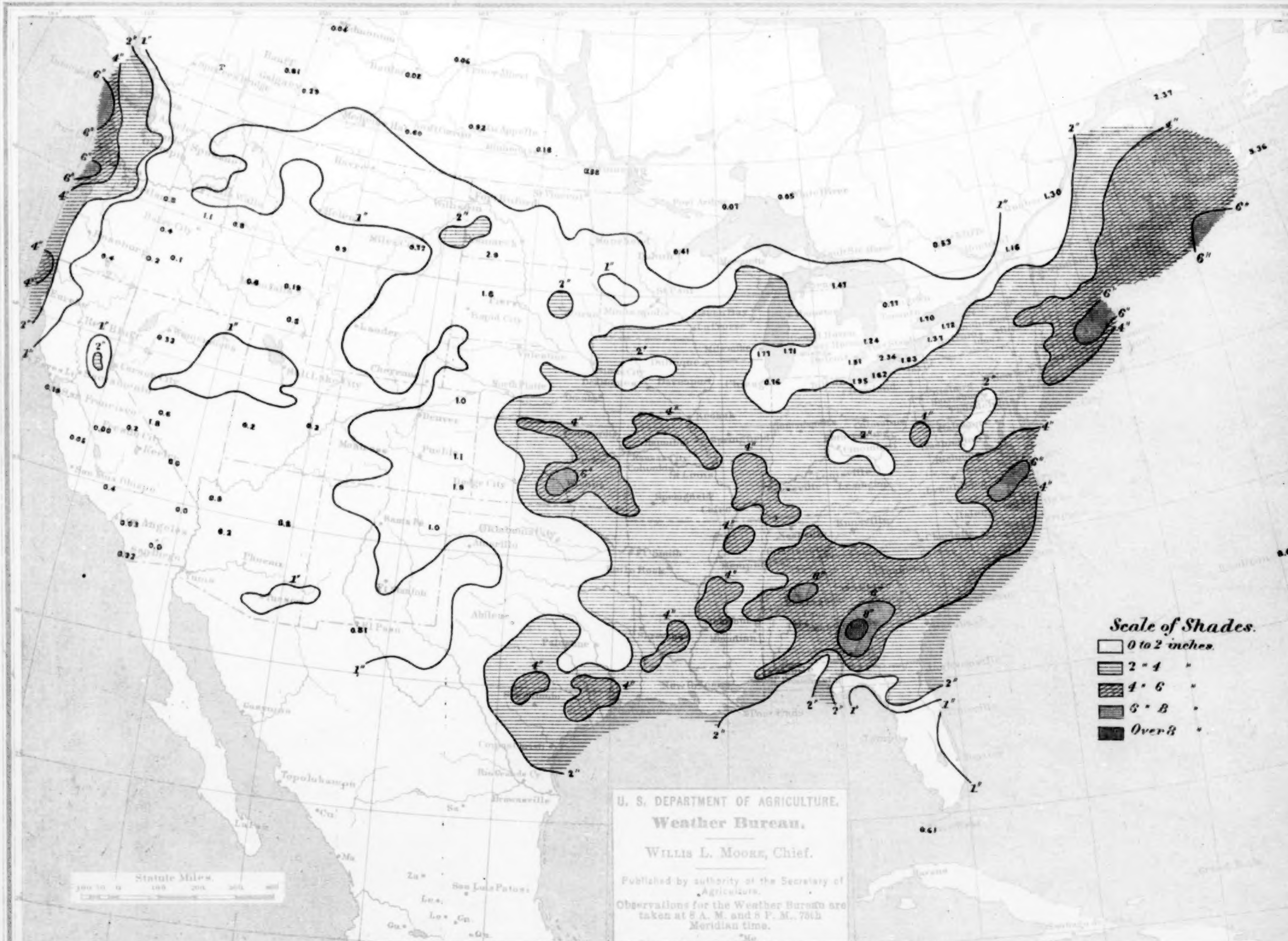
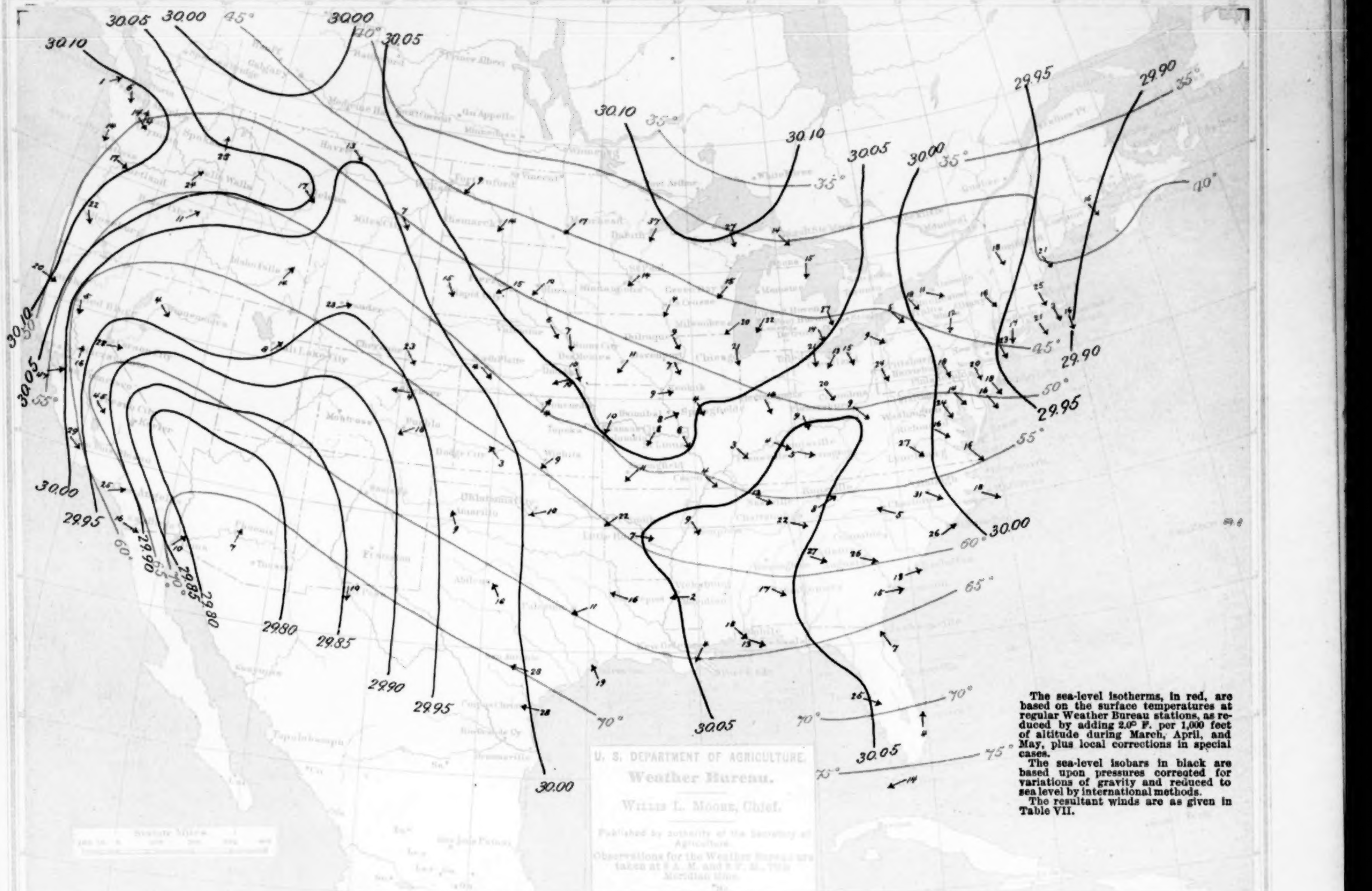


Chart IV. Sea-Level Pressure and Temperature and Resultant Surface Winds. April, 1898.



The sea-level isotherms, in red, are based on the surface temperatures at regular Weather Bureau stations, as reduced by adding 2.0° F. per 1,000 feet of altitude during March, April, and May, plus local corrections in special cases.

The sea-level isobars in black are based upon pressures corrected for variations of gravity and reduced to sea level by international methods.

The resultant winds are as given in Table VII.

Chart V. Hydrographs for Seven Principal Rivers of the United States. April, 1898.

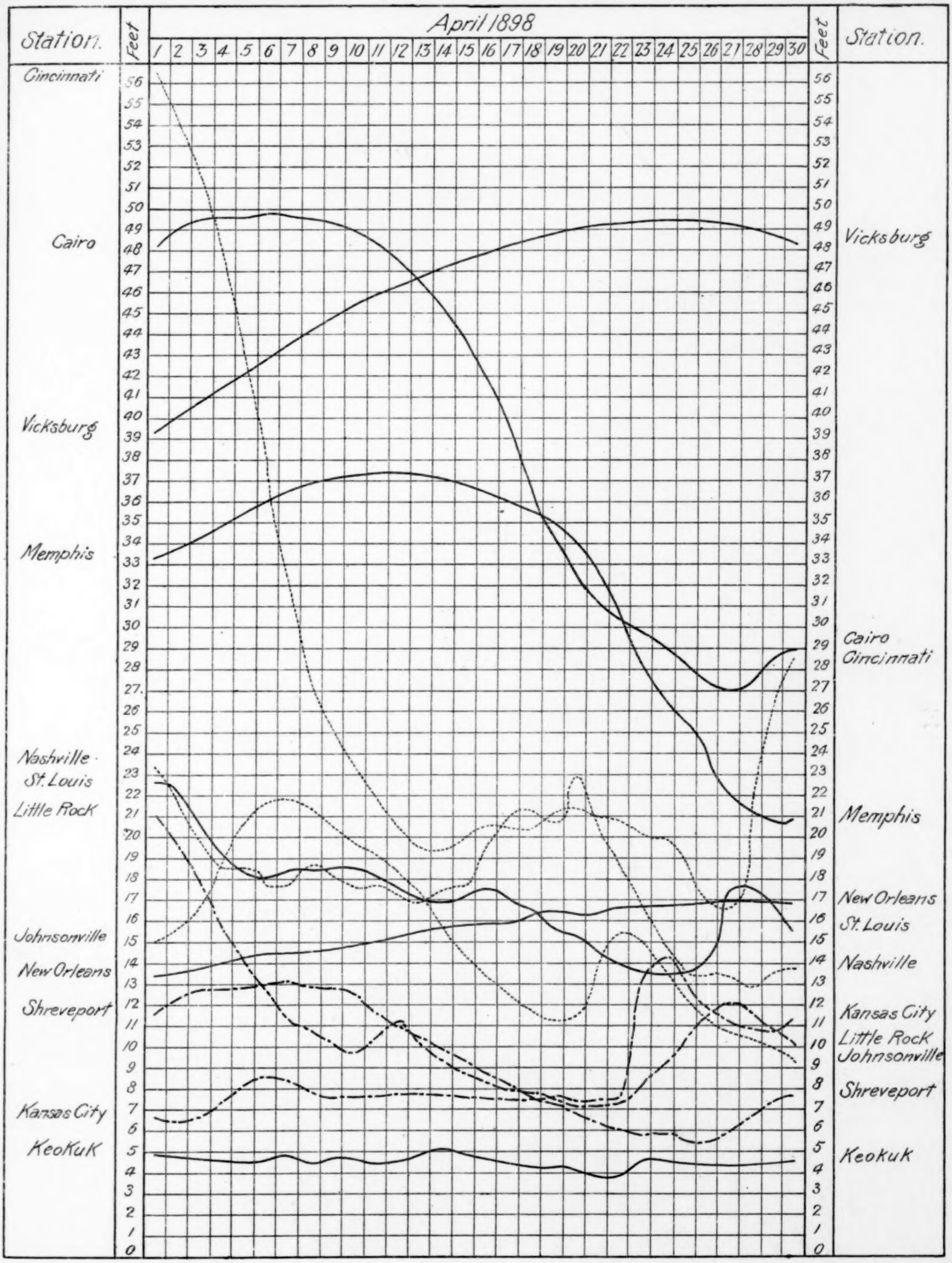


Chart VI. Surface Temperatures; Maximum, Minimum, and Mean. April, 1898.

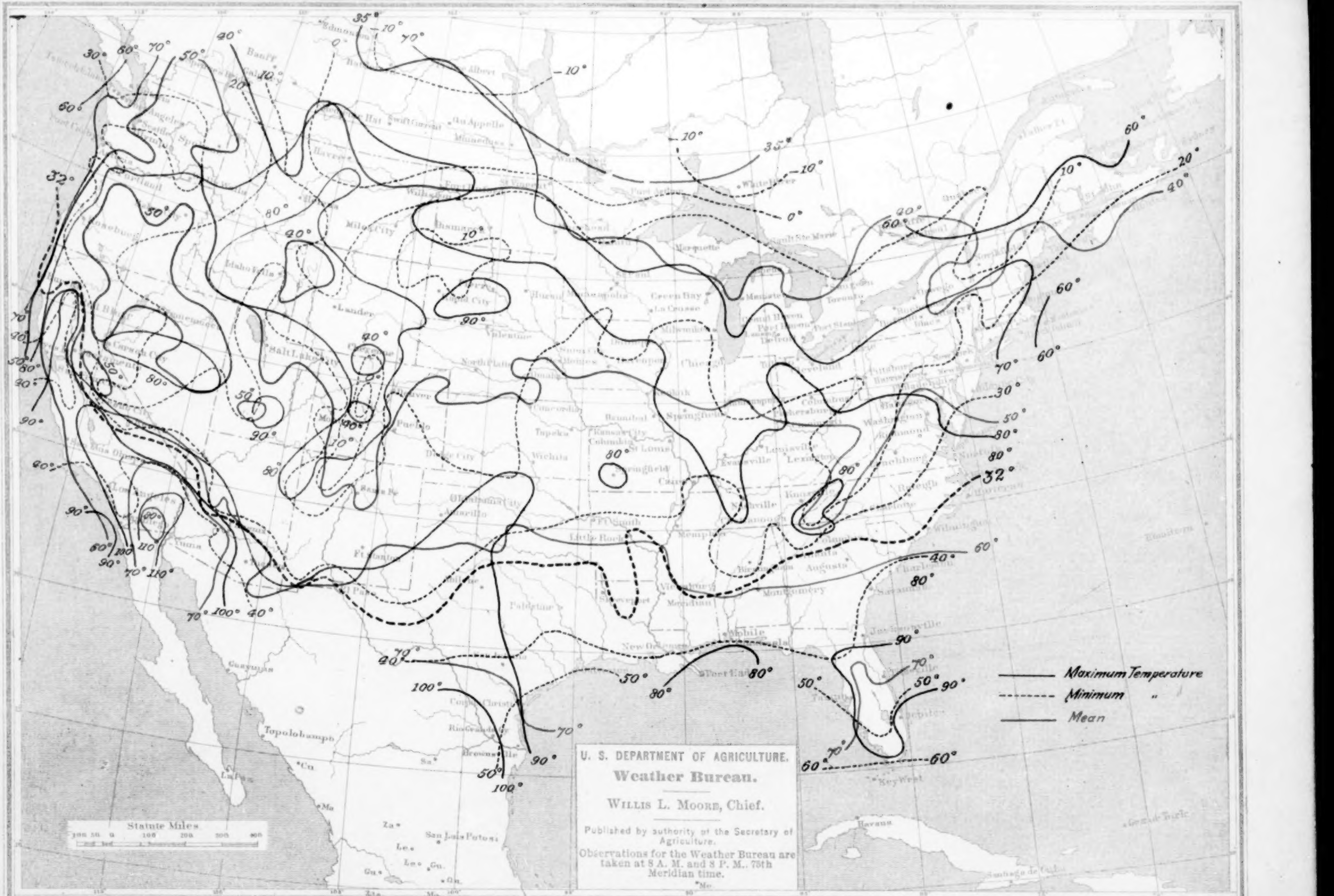


Chart VII. Percentage of Sunshine. April, 1898.

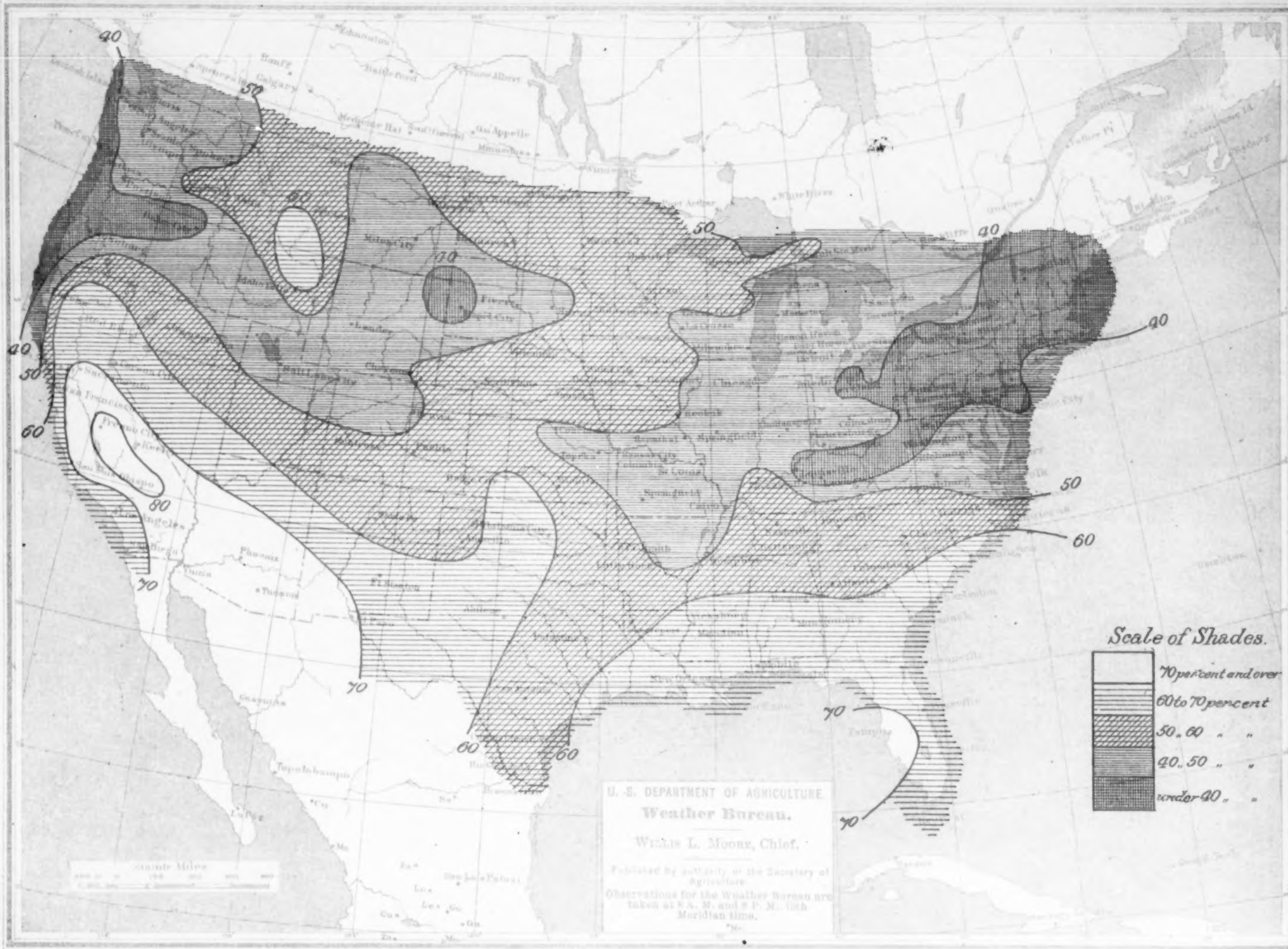


Chart VIII. Total Snowfall. April, 1898.